RADIO and ELECTRICAL Review

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OCTOBER 1st, 1956

VOL. 11, NO. 8

PRICE 1/10

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OUR COVER PICTURE this month depicts final tests in progress on a TV Outside Broadcast Mobile Control Room, built by Marconi's Wireless Telegraph Company Ltd. for Cinema Television Ltd. In the foreground are the producers' sound and vision controls, while beyond can be seen the monitoring equipment.

Official Journal of

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The New Zealand Radio and Television Manufacturers' Federation.

The New Zealand Radio and Electrical Traders' Federation.

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Subscriptions:
1s. 10d. per copy; 23s. 6d. per annum, posted.

Advertising Rates supplied on application.

CORRESPONDENCE

All correspondence and contributions should be addressed to:

The Editor,
"Radio and Electrical Review",
P.O. Box 8022,
Wellington, New Zealand.

OFFICES AND LABORATORY:

Radio and Electronics (N.Z.) Ltd.,
46 Mercer Street, Wellington.
Telephone, Wellington, 70-216.
Telegrams and Cables:
"Radel", Wellington.

SOLE ADVERTISING REPRESENTATIVES for THE UNITED KINGDOM:
Cowlishaw and Lawrence (Advertising), Ltd., P.O. Box 656, 14–16 Ludgate Hill, London, E.C.4. Telephones: City 3718.
Cables: Cowlawads, London.

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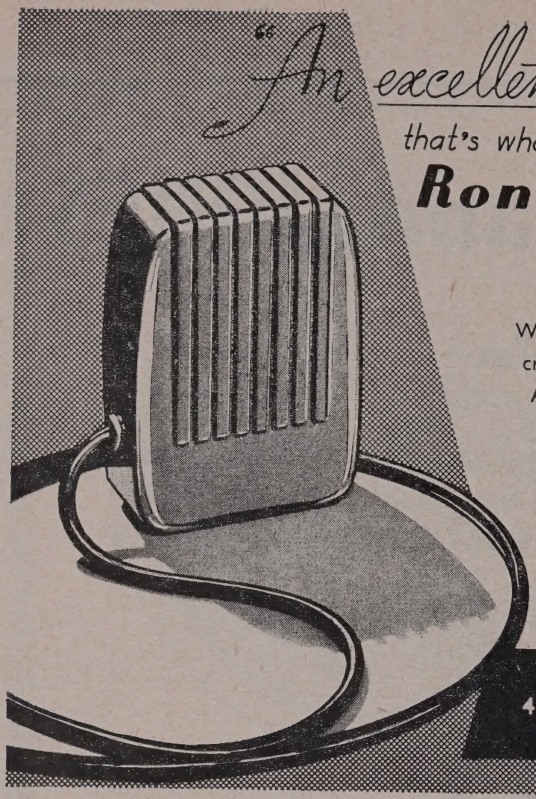

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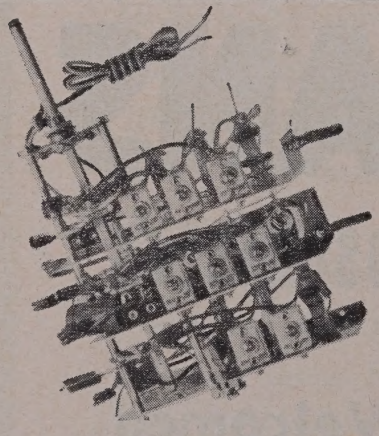

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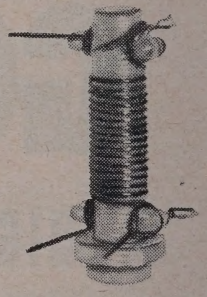

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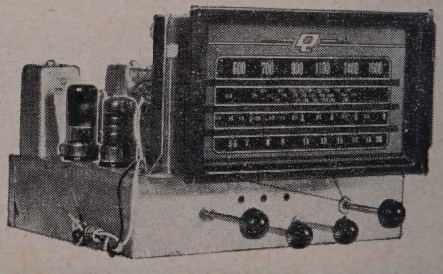

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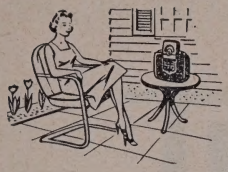

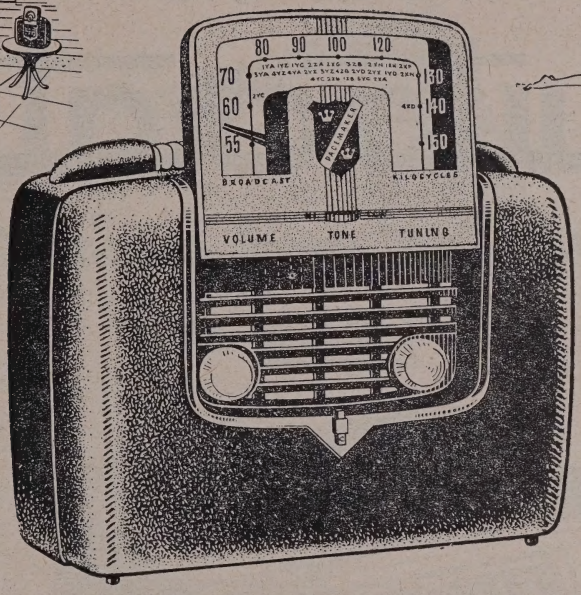

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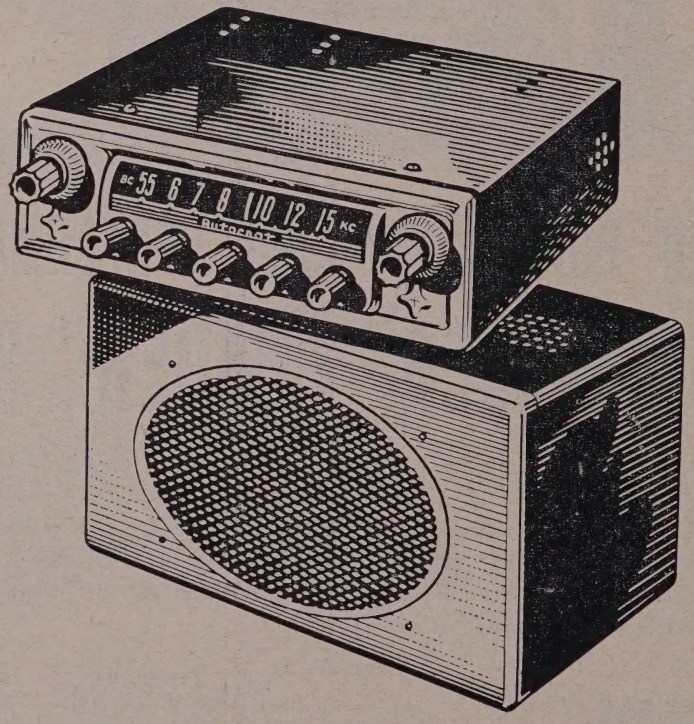

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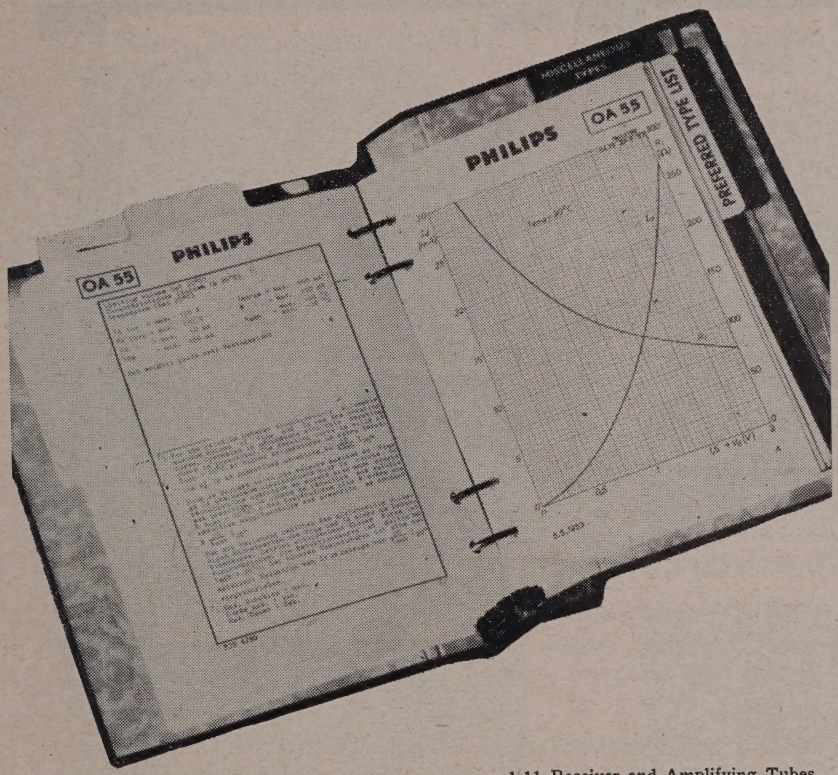

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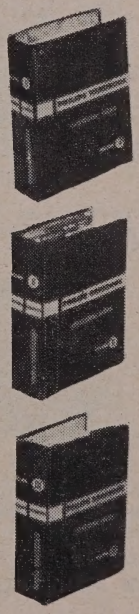

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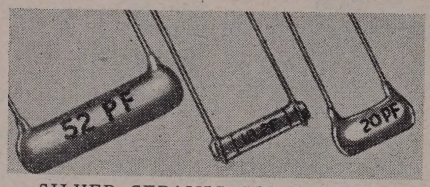

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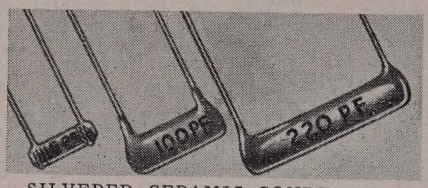

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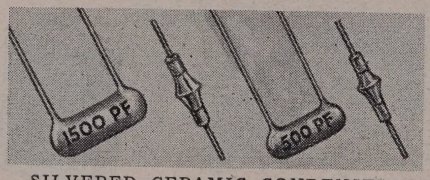

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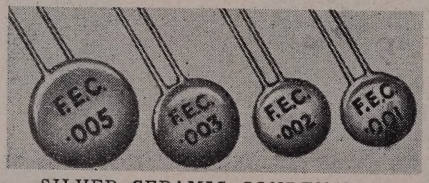

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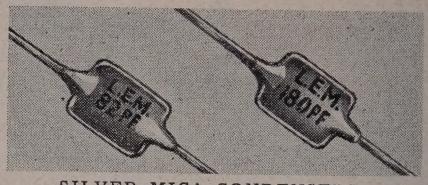

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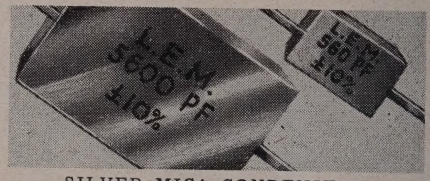

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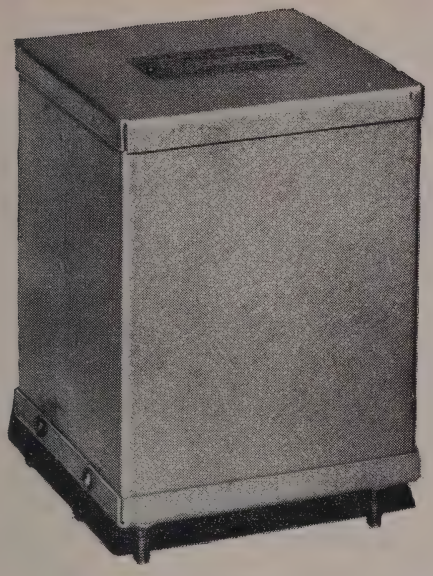

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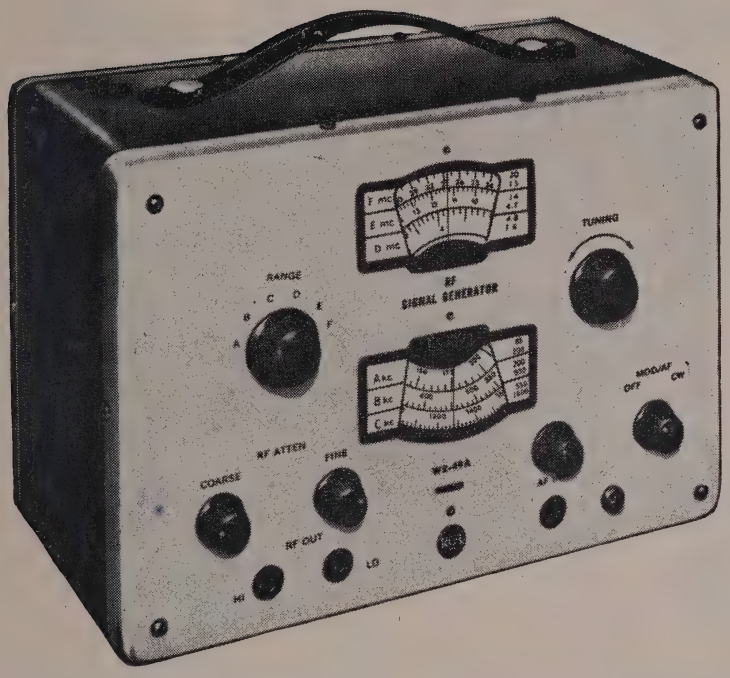

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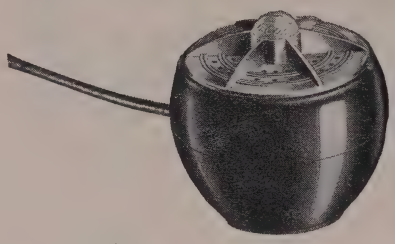

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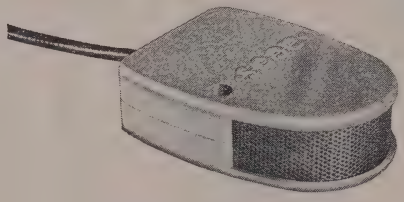

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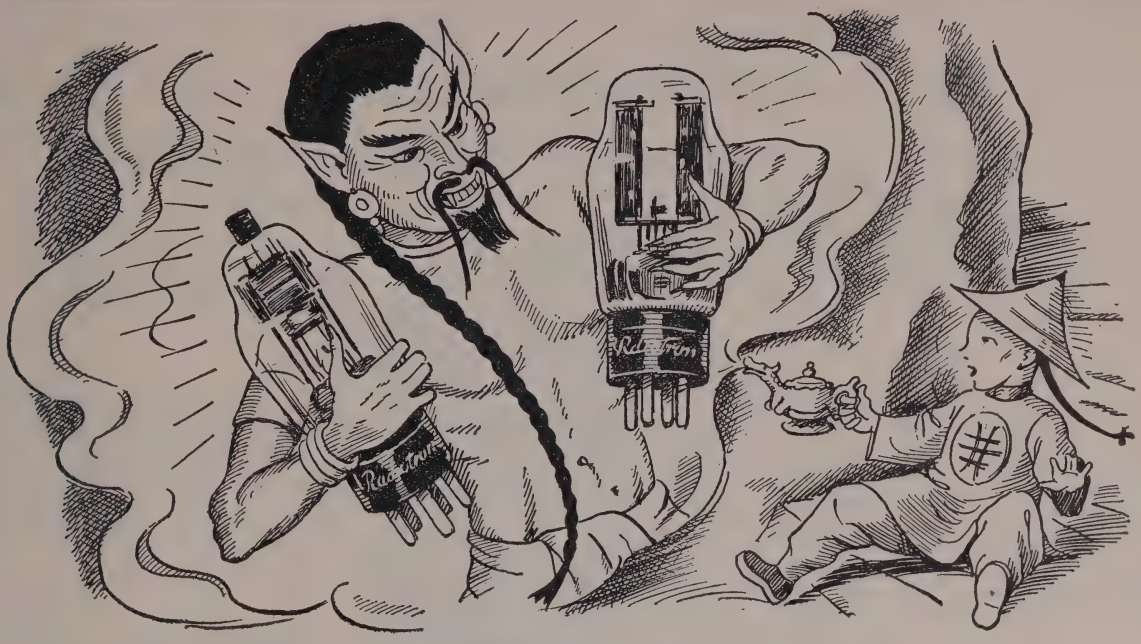

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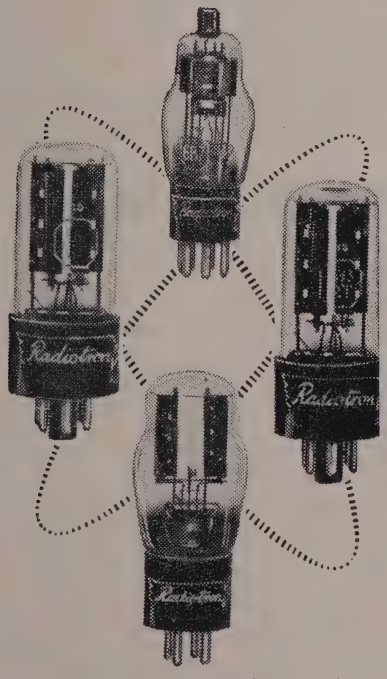

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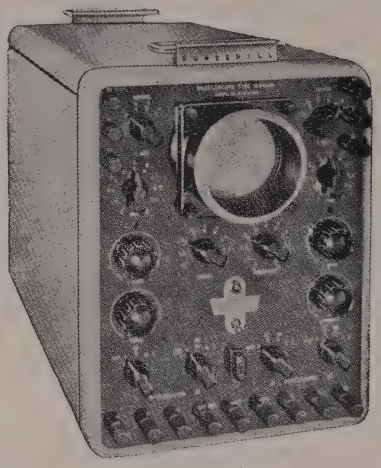

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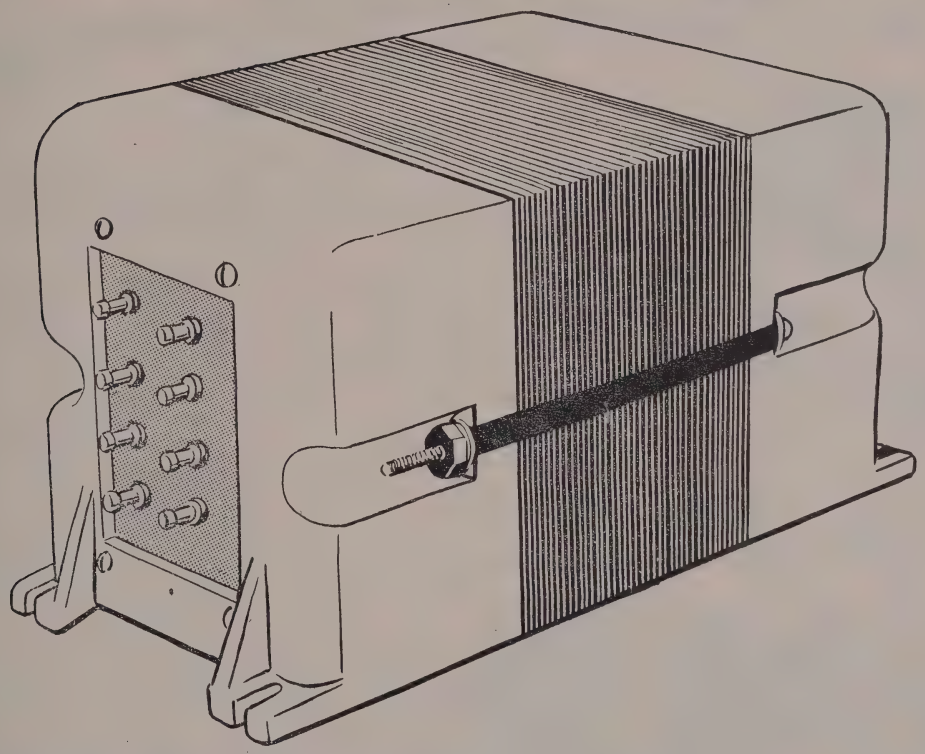
ULTRALINEAR

Output TRANSFORMERS



Considerable interest has recently been taken in the American ultralinear version of the famous Williamson Amplifier. A reduction in distortion and an increase in power output over that of the Williamson Amplifier has been claimed by the originators of the circuit. As in the Williamson Amplifier, a major part is played by the design and construction of the output transformer. BEACON makes a transformer rated at 30 watts which will work well when used in an ultralinear circuit. Screen taps are available so that push-pull KT66 valves, or similar types, may be used as pentodes with a sharing of load between screens and plates. The frequency response over the audio frequency band is excellent. We recommend this transformer for use in amplifiers where greater power output than that obtainable from the normal Williamson Amplifier is required. Cat. No. 53S66, 30-watt ultralinear output transformer, 6,600 ohms P to P to 1-4-9-16 ohms.

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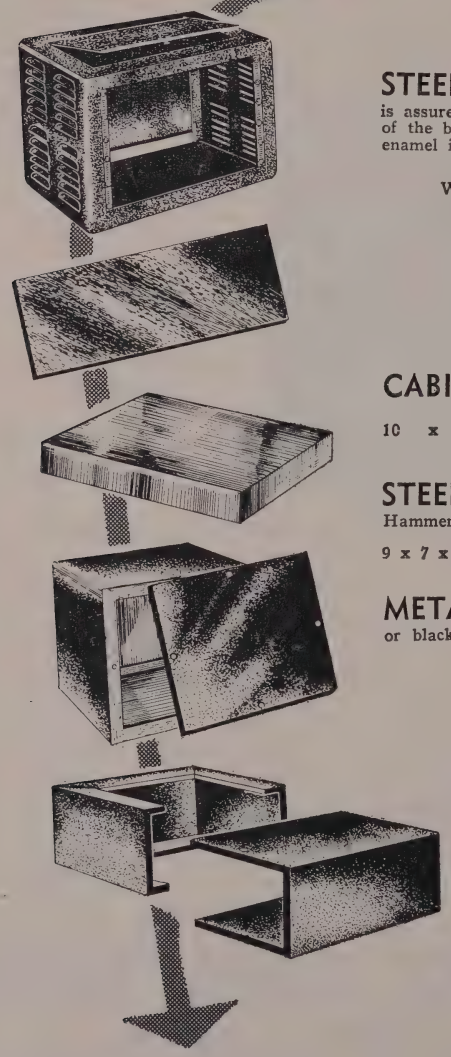

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Depth	Width	Height	Price
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4	5	6	10/-
5	6	9	15/-
6	7	12	20/-
7	9	15	22/6

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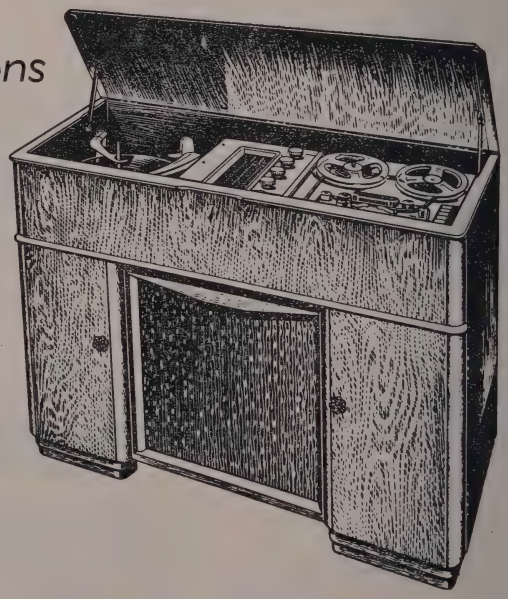

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Local-Body Trading in Electrical Appliances

REGULAR readers of this page will remember that earlier this year, the New Zealand Radio and Electrical Traders' Federation, together with other bodies, brought to the notice of the Government the fact that many electricity supply authorities were indulging in considerable trading activity in all classes of home electrical appliance. The Minister of Industries and Commerce, Mr Watts, gave the deputation a favourable hearing, and indicated that while he could not make a ruling on any such matter himself, he would place the matter before Cabinet for discussion and possible action. The question has now been discussed by Cabinet, and a reply sent to the Federation. Unfortunately, however, the Government has decided to take no action in the meantime, and has assured the Federation that it will keep the matter under review, and may possibly do something about it if supply authority trading becomes more extensive.

It seems to us that this is a most unsatisfactory answer. It will be remembered that the main ground of complaint is that local bodies and power authorities pay no income tax, since tax on electric power is paid, at higher level, by the State Hydro-electric Department, and because there is no legal means of differentiating between the profits made by a power board from the sale of electricity, or from the sale of appliances. To the extent that power boards pay no tax on their trading activities, their competition with the radio and electrical trade is most unfair, and there are other aspects of the case that are equally open to criticism.

In short, the case put to the Government by the Federation is a good one, both in principle, and because local body trading has already reached large proportions, especially in some districts. In its reply, the Government has agreed, by implication, that the Federation has a case. In view of the facts, it could do little else, and so it is all the more extraordinary that it refuses, at the moment to take any action. There is no doubt that taking the appropriate steps would be quite a job, administratively, as it would probably involve amendments to at least one Act, but that is no real reason for delay. In effect, the Government has said "We agree that radio and electrical dealers are at a disadvantage, but we do not think the situation is bad enough to require action on our part, yet."

In so replying, the Government does less than justice to the Federation. Surely, those people whose business is adversely affected should be allowed to judge whether or not action is required now or later. By the same token, if it is agreed, as it appears to be, that a wrong exists which should be righted, elementary justice demands that it should be righted as soon as possible.

It is clear from the figures prepared by the Federation, that in some districts, power board trading is negligible, but that in others, notably Christchurch and Wanganui, it has already reached very considerable proportions; in these and other centres, the businesses of private traders must have been quite heavily affected already, and it is cold comfort to these people to be told that in the Government's opinion, matters are not yet serious enough to warrant action. This journal hopes that the New Zealand Radio and Electrical Traders' Federation will not let the matter rest here, and that with the assistance of other bodies with whom its interest in the problem can be unified, it will make further representations to the "powers that be". At least, in this case, the said "powers" are not anonymous!

Measurements

THE MEASUREMENT OF INTERMODULATION DISTORTION

Previous articles in these pages have discussed questions relating to the measurement of distortion, both harmonic and intermodulation. This article describes the main features of an instrument which has been built in our laboratory for accurately measuring percentage intermodulation down to very small quantities.

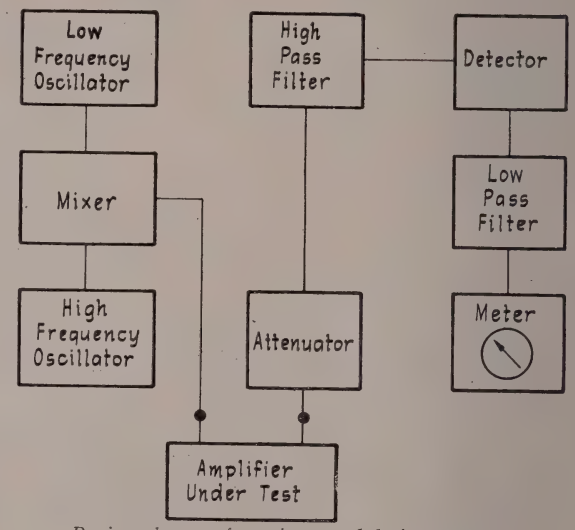
INTRODUCTION

It is unfortunate that simplified methods of obtaining complex results almost always suffer from one or more limitations. In to this category comes the measurement of intermodulation distortion. As most will agree, this is not the simplest of quantities to measure, and the idea of using an oscilloscope for the purpose seems very attractive at first. It is quite practicable to do so, but as we will see later, the method is not capable of measuring very small quantities of distortion. When an amplifier is designed or built, it is hoped that the intermodulation over most of its output range will be a good deal less than 100%, or even 10%, consequently a method that is at its best when measuring percentages of 50 or over is of limited interest. If it is hoped to be able to measure distortion products smaller than one per cent., it is necessary to perform the measurement "the hard way". Not that there is anything exceedingly difficult about the job, for there is not, but it does involve quite a deal of equipment, and there are several things to be considered if the resulting device is to be successful, so that the design and building of the equipment is quite a big job if tackled from scratch.

Even so, it is one that is worth doing, because although it is possible to do without such instruments, they are exceedingly useful tools for anyone who is seriously engaged in audio frequency work of whatever kind. For that reason, we have not only constructed the equipment for use in our own laboratory, but have decided to publish the design in these pages, so that anyone who may wish to build it for himself may do so. The purpose of this preliminary article is to act as a fore-runner of the one commencing in next month's issue, describing the circuits of the intermodulation meter.

INTERMODULATION MEASUREMENT

We hope that this, and its succeeding article will be read not only by those who propose to build the equipment for themselves (for these will probably not be very numerous) but by those who are interested in the results that can be obtained with it, who on the contrary are undoubtedly many. With such an instrument, the work of testing audio equipment of all sorts is very much speeded up, as the intermodulation meter can very rapidly give the answer to questions that either cannot be answered in any other way, or only with considerable difficulty, and perhaps by the much more unsatisfactory method of listening. We are not among those who believe that instruments can always tell the story better than the ear, but at the same time, it is realized that instruments can be much more sensitive, and that when

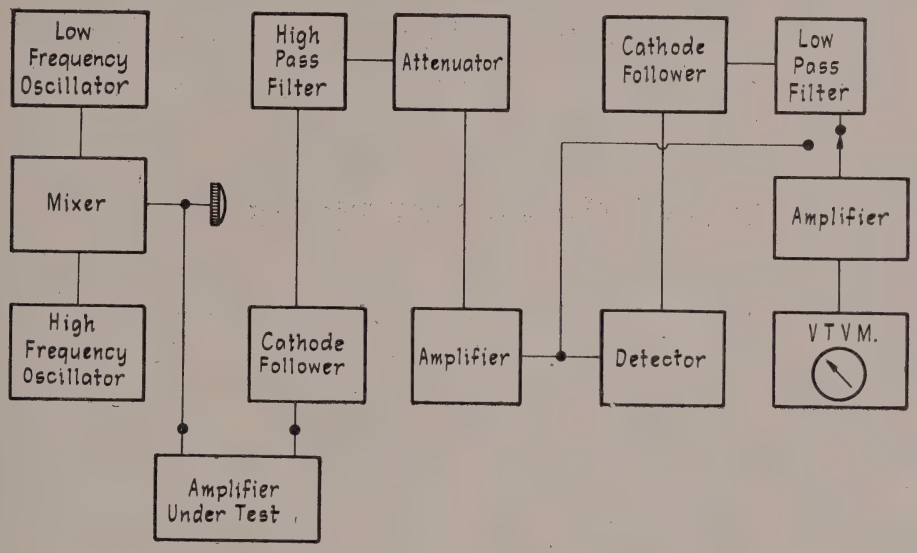


Basic scheme of an intermodulation meter.

used with circumspection, they are indispensable as an aid to the ear. Amplifiers, to take only one concrete example, are so good these days, that it is a very bold man who would state categorically, on the basis solely of listening tests, that one amplifier is much better than another. True, the more practised the judge, the more likely is he to be correct in such judgements, but except where unlimited time is available, it is entirely uneconomic to make them at all. For instance, if one is building a number of amplifiers for sale, it will be worth while to subject a pilot model to several instrumental and listening tests. Between the two, the true worth of the new product may be evaluated. But when it comes to assessing whether or not the production samples are as good as the prototype, it is a very different story. There is no time at all for the listening tests, unless very brief, so that instruments have to be relied upon completely. As for distortion, it is perfectly permissible to use an instrument such as a total harmonic distortion meter, or an intermodulation meter, because unless the sample under test is faulty, it should give very similar figures to others of the same design, and the use of instruments can very quickly result in a unit's acceptance or rejection with only a very small margin of error.

It should not be necessary to explain in detail why intermodulation measurements are to be preferred to those of total harmonic distortion, since all this is to be found in the well-known text books, and because such august bodies as the Society of Motion Picture

Engineers (of America) have laid down standard methods of measurement, in order that results obtained by different people on equipment of different design may, as far as possible, give comparable results. The main virtue of intermodulation measurements as such is that they appear to agree rather better with the results of large-scale listening tests than do other methods of evaluating subjective distortion.



Practical elaboration of the basic set-up, as used in equipment to be described.

The latter is a term that is much found in the literature, but which is not always explained as clearly as it should, or even at all. Meters are as nearly as it is possible to make them, completely objective. That is to say, the results obtained by their use should not be influenced by the opinions or preferences of the person or persons using them. For many purposes, this is an ideal state of affairs, because meters form a means of getting at what we hope is the scientific truth, uncoloured by personal considerations of any sort. Of course, meters can be wrong, but that is only because, like every other man-made thing, they are not perfect. It is usual to provide a meter with some worth-while estimate of by how much its readings are likely to be in error, so that this can be a guide to the user, who will therefore either agree that it measures what he wants to know to a sufficient standard of accuracy, or else will consider that the effects he wishes to measure are incapable of being measured by it with enough accuracy to make its use worth while. Unfortunately, however, meters can be much more wrong than the above might indicate, when they are misapplied, or when their use is not understood. In the early days of valve amplifiers, means were devised by engineers for measuring the percentage distortion produced by an amplifier when handling a pure tone. The instruments were ingenious, and scientifically accurate, but at first,, quite unknowingly, some very inaccurate conclusions were drawn from them. On the general thesis that the more distortion an amplifier produces, the more unpleasant it is likely to sound, figures for percentage harmonic distortion were, and still are quoted by equipment designers. The only trouble with this is that while the meter may measure, with considerable accuracy, the amplitudes of the various harmonics produced from a pure tone by an imperfect amplifier, the same meter has no means of telling what effect these percentages of distortion will have on a listener when the programme is a musical one. The latter question is a subjective matter, that cannot be solved by any objective means whatever. We have advanced a good deal farther than merely to have found out that the percentage of harmonic distortion cannot be used, as a measure of the unpleasantness of the sound produced, but we still have not devised a single measurement that, when made will give a measure of the annoyance value of the kind of distortion produced by an amplifier, or other piece of audio equipment. This being so, it is still possible for objective measurements to disagree violently with the results of scientifically carried out listening tests, but the measurement of intermodulation is a definite step in the right direction. A physical reason for this is to be found in these facts. (a) Most harmonics of a fundamental tone are not dissonant with it. In other words, they have little annoyance-potential to the ear. (b) On the other hand, intermodulation products are seldom anything but dissonant. Thus, as we are seeking a method of measuring not distortion, as such, but the effect it has on the ear, it is logical to suppose that in all probability, measuring the intermodulation which occurs between two tones that are fed to an amplifier at the same time is much nearer to what is wanted than is the measurement of the harmonics of a single tone. Careful tests have been carried out by various workers in the field, and have shown that while there is practical justification for thinking that intermodulation measurement is better than harmonic distortion measurement, the results obtained do vary considerably according to the method chosen for making the intermodulation tests, and that there is still no clear-cut correspondence between the measurements and listening tests. This does not mean that intermodulation measurement is not worth the trouble. Far from it. Indeed, there is good reason to use the method, for even though it is not perfect, it is still better than anything else that has been devised.

METHODS IN USE

Readers may wonder why we have mentioned a variety of methods of measuring intermodulation distortion. This variety exists solely because there are so many controllable variables, that it is literally possible to take the measurements in an infinitely great number of different ways, and unless results that are to be compared are taken in exactly the same way, there is no valid basis of comparison between them. However, in spite of this, the possible number of basic methods is not very great. The infinite variety referred to are matters of detail rather than of principle.

The commonest method is as follows. A signal, consisting of two pure tones, mixed in stated proportions, in such a way that there is no intermodulation between them before they are applied to the device under test, is applied to the input of the amplifier to be tested. The latter's gain control is set to give the power output desired for the test, and the output is taken to the intermodulation meter. If the amplifier is distortionless, the outcoming signal is also free of distortion, which means that there will be no intermodulation either. However, if distortion takes place, the output will contain not only harmonics of both the tones used, but also sum and difference frequencies. Thus, it becomes possible to filter out these frequencies and measure their amplitude compared with the original tones. They can then be expressed as a percentage of the original tone amplitude, or of that of one of them. Usually, one tone is of quite low frequency, while the other is high. This is largely a matter of convenience in measurement. The most important intermodulation products are those resulting from the sum and difference of the two frequencies. Others are those resulting from the sum and difference of the high frequency with the harmonics of the low one. In general, those products of higher frequency, such as the second and third harmonics of the high frequency together with the sum and difference frequencies between these and the low frequency are small in amplitude, and are ignored in the measuring process, but frequently the apparatus is capable of measuring them along with the primary intermodulation frequencies.

It should be noted that the main frequencies of interest are in the close vicinity of the high frequency test tone, and indeed correspond exactly to the latter, as a carrier, modulated with the low frequency and its harmonics. If the low frequency is filtered from the amplifier output, what is left is this high-frequency modulated carrier, and an intermodulation meter is merely a device for filtering the low frequency tone from the output, and for measuring the depth of modulation of the high-frequency "carrier". The details which must be settled before it is possible to construct an instrument of this kind include the test frequencies, their relative amplitudes in the mixed test signal, and the method to be used for measuring the percentage modulation of the high-frequency tone, after the low-frequency one has been removed by filtering. Again the commonest method is to place the H.F. tone in the region of 4,000 c/sec., and the low-frequency one somewhere near the low-frequency limit of the amplifier, as for example, at 40 or 60 c/sec. Spacing the tones well apart has the advantage of making the measurements easier without much effect on the actual results. It is usual, too, to make the amplitude of the L.F. tone four times that of the H.F. one. Sometimes a greater ratio is used, as this tends to make it easier to measure small degrees of distortion.

Fundamentally, the final measurement of the modulation percentage is little different from measuring the modulation percentage of a radio frequency carrier. The task is more difficult, though, because the ratio of carrier frequency to modulation frequency is much smaller, and also because we are interested in accurate measurement of very small modulation percentages. The basic set-up is illustrated in the diagram in block form, and is seen not to be too fearsome. However, when one comes to do the job, minor difficulties pop up all over the place, and a detailed block diagram has considerably more blocks in it than the simple one shown here. It is thought that readers will find considerable interest in following the development of the actual instrument from the simple diagram given here, to the relatively complex circuit which will be given in the succeeding article.

N.Z.A.R.T. NOTES

(Supplied by the Publicity Committee, N.Z.A.R.T., P.O. Box 1733, Christchurch, to whom all inquiries should be addressed).

A feature of the Southland Centennial Celebrations was the dinner and dance held recently at Elmwood Gardens, Invercargill, by the local branch. Over 120 guests attended, including the President of the N.Z.A.R.T., Mr H. F. Arnold and Mrs Arnold. This was the first presidential visit to Invercargill for many years, and marks the continuation of the new policy whereby Council members are to visit the more remote branches. It is hoped that with the experience thus gained and the happy associations now firmly established, Invercargill boys will be to the forefront in future National Conferences.

While welcoming delegates to his city, Mayor A. L. Adamson paid tribute to the part played in the community by amateur radio, and wished the Association, and the Invercargill Branch in particular, every success in the future.

After-dinner speeches interspersed with items preceded the dance, the occasion affording good opportunity for the swapping of DX stories and general circuit natter.

Quite an outstanding feature of the evening was the playing of an electronic organ constructed by Mr M. E. Mills, ZL4GY, the instrument providing the music for the dancing as well as demonstrating the aptitude and patience of the constructor.

A visit to Awarua Radio took place the following day, when members were interested to investigate the technical working of a commercial station, especially the receiving and transmitting equipment. The new "Philips" receivers excited considerable interest, but, unfortunately, conditions precluded favourable reception.

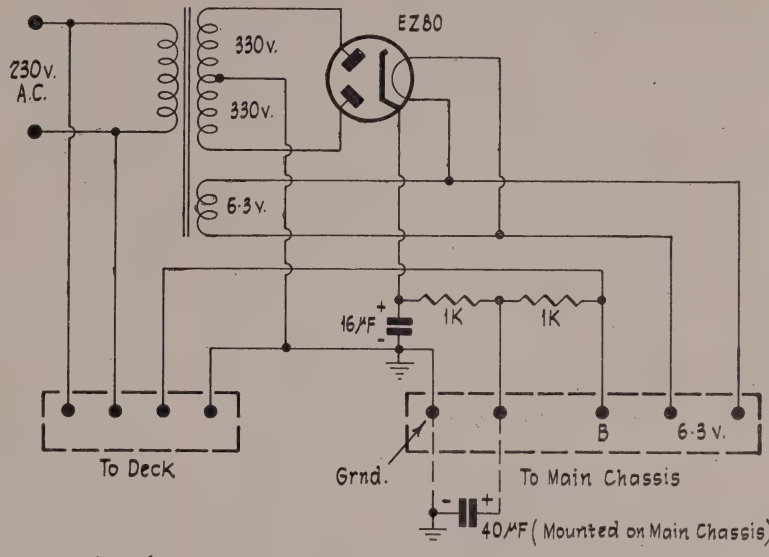
From the "near south" to the "far south" is quite a step, and though, as yet, the KC4 stations have not been worked by many of the ZL amateurs, things may change when the population of the Antarctic regions increases. There have been isolated instances of amateurs working the Russian base at Mirny, and, to date, this and the American stations are the only representatives.

At the end of the year our own New Zealand party should be on the job, and we understand that much of their time devoted to amateur radio will be spent on the 80-metre band. According to report, our operators will maintain a "black book", in which the quickest way to figure is to follow the "bust it up technique" and endeavour to butt in. Advice is to wait your turn and do not call on frequency.

THE "R. & E." TAPE-RECORDING AMPLIFIER

Parts 1 and 2 of this series of articles describe the circuits used in a complete record/playback system adaptable to any tape deck with high-impedance heads. In this, the last instalment of the series, we describe the setting-up of the circuits and their adjustment for any particular brand of tape.

As was mentioned early in the articles, it is a good plan to build the circuits piece-meal, and test each one individually. This is more easily done if one has access to some pre-recorded tapes, such as the commercially available ones which are duplicates of music that has already been issued on L/P records. Perhaps the best order of doing things is to build up the little sub-assembly which mounts under the deck, and includes the bias feed arrangements. If this is done immediately after the additional lead is put on the R/P head, a complete test of the playback amplifier will be possible as soon as the two valves of the latter have been wired up and temporarily attached to a power supply, giving a well-smoothed 300 volts. It will not be necessary to have the circuit containing L_3 tuned to the proper frequency for playback testing, and yet having the head circuit completely installed will show exactly what answers will be obtained with respect to such important matters as hum pick-up on playback, head azimuth alignment, and playback frequency response.



HUM PICKUP

In the original equipment, it was found quite unnecessary to use any of the usual expedients for getting rid of hum, in spite of the very high amplification at 50 cycles and below. First of all, all heater wiring was made independently of the chassis, and was run in shielded twisted pair. In other words, there is no earth of any sort on the heater circuit, and all heater wiring is shielded except for the emergence of half an inch or so of wire at each heater pin on all the valve sockets. Of course, the heater circuit does get earthed later on, in particular, when the wiring of the playback amplifier is complete and the latter is ready to be tested. Hum pick-up during recording is not a problem, and all hum-reduction can be tackled in relation to playback. The first step after getting the playback amplifier working is to temporarily connect a 100-ohm potentiometer across the heater circuit, right at the heater pins of the first EF86 in the playback amplifier. Then, the deck is loaded with a pre-recorded tape, which is played back through a good amplifier and speaker that is known to have good response down to 50 c/sec. If all is reasonably well, the hum level will be very low, but it cannot be expected at this stage to be entirely inaudible. The way to judge the hum level is to play the tape at the highest level that is likely to be used, leaving the amplifier gain control at this setting. Then, remove the tape from the deck, and listen for hum with the switch in the "play" position, i.e., with the deck running just as it does during playback. This means that the same motors will be on that are used during playback, and this is what counts, for there is no virtue in adjusting the hum level with the re-wind motor functioning. The hum-field at the head will be different under these conditions, and in any case we are not interested in what happens when we are not listening to a recording. If the hum is inaudible with the gain control set at the highest possible listening level, then there is no hum problem. It will almost certainly be possible to hear some hum if the amplifier is much more sensitive than is required by the playback pre-amplifier, and if the wick is turned right up. Such a test, however, is quite unrealistic, because hum that is inaudible at the highest likely listening level will never become audible under practical conditions. However, it is a good idea, if there is gain to spare, to turn the gain control up higher than the listening level after the initial check has been made, because when the hum level is already low, turning up the gain will enable changes, and in particular, small reductions, to be evaluated more easily. The temporary potentiometer is adjusted for minimum hum output, and the position of the slider is then measured. This is done by removing the potentiometer carefully from the circuit without disturbing its setting, and measuring the resistance from each side to the centre contact with an ohm-meter. This test shows whether the position for maximum hum is near the centre or near one end. In our own case, it was found that the position for minimum hum was very broad, and that it was so near the centre that there was no disadvantage in replacing the potentiometer in the circuit by two fixed 50-ohm resistors, wired in right

at the heater pins of the first EF86 in the playback pre-amplifier. If it should be found that the position for least hum is close to one end of the potentiometer, the best answer will be obtained by simply earthing the heater pin indicated by the position of the slider. The sort of behaviour described, in which the hum minimum is very broad, indicates that we are not in fact balancing out hum from some other part of the circuit by injecting heater hum in anti-phase. In this particular instance, it shows that the hum pick-up by the R/P head is so slight as to be negligible, and this is one up to the maker of the deck. Many decks are not nearly so successful in this respect.

One feature of our unusual head circuit is important. It will be noticed that on the diagram, Fig. 1, and in its description in Part 1 of this series, each lead from the R/P head has its own bit of co-axial cable. In the photograph it will be seen that these are brought side-by-side into the amplifier chassis, and that at the deck end, they are both taken to a three-pin connector. Thus, the shield braid of the two pieces of cable is joined at both ends. When the amplifier is installed, upright in front of the deck, the head cables have to pass quite close to the motors, and it has been noticed that there is a noticeable increase of hum if the two leads are splayed out. But if they are kept close together, by binding them with cellotape every few inches, they can then run very close to the motors without picking up hum. An even better solution is to bare the insulation for half an inch every four inches or so, and solder the shield braids together at these points. The cable to the erase head can take any route, and has no bearing on the playback hum, as would be expected.

AZIMUTH ADJUSTMENT

The next thing to be adjusted is the position of the gap in the R/P head. Most decks have some method whereby the head can be tilted so as to make the gap accurately vertical, or more strictly, at right-angles to the run of the tape. This is what is known in the literature as azimuth adjustment. In the deck illustrated, the adjustment is by means of a set-screw in the middle of the bottom plate on which the heads are mounted. This bottom plate is not part of the main plywood and aluminium base-plate, but is set into a cut-out in it. Through the centre of the head mounting plate comes a pin, over which is a small compression coil spring, held on by a split-pin. Just to the left of this is a small screw head which is the azimuth adjustment screw. In the absence of complex test gear as is used in laboratories, the best way of adjusting the azimuth is to set the position of the head so as to give maximum high-frequency response from a pre-recorded tape. If tapes made on other machines are not to be used at all, the question of azimuth adjustment is quite an academic one, because if the gap has a slight tilt during recording, the tilt during playback will be identical, so that a tape made and played back on the same machine will automatically reproduce correctly. The main effect of incorrectly adjusted azimuth is loss of high frequencies, and this explains the method of adjustment. The loss of highs can be quite marked, so it is a matter of some importance to have the azimuth properly aligned.

PLAYBACK AMPLIFIER RESPONSE

As already described, the response of the playback amplifier should be flat above about 2000 c/sec. As the frequency is reduced, the response rises, and should be 3 db. up at 1600 c/sec. Thereafter the rise is almost exactly 6 db. per octave with the circuit used, and a very comprehensive check is not required. If one does not have an oscillator and an oscilloscope, it is pretty safe to take the response of the amplifier for granted. The only thing that can go wrong is the feedback condenser from the plate of the second EF86. Should this be away off tolerance, the rise in response will start at too low or too high a frequency. Too low if the C is too large, and vice-versa. One reader who has access to standard tapes and who has been using our playback amplifier for some time tells us that the standard tape when played back through it shows a response exactly flat, plus and minus 0 db., from 40 to 10,000 c/sec., so that others should be able to place every confidence in the circuit, one of whose beauties is its extreme simplicity, and freedom from things to go wrong. It will be noted that on playback, the head is shunted by a 100 $\mu\mu$fd. condenser, which tunes it to approximately 14 kc/sec. This is to bring up the extreme highs a little, and gives the desired result with the head used in the deck.

TUNING THE ERASE AND BIAS CIRCUITS

After checking the playback section, and playing a few pre-recorded tapes to show how nice they sound (if you can get hold of them or afford to buy them) the next job is to construct the H.F. oscillator and amplifier. This part of the circuit draws about 50 ma., at 300 volts, and it can be tested for satisfactory operation with any suitable power supply. If desired, the power supply circuit shown here can be built up first, and used for all the experimental work. It is very simple, and gets away without a smoothing choke, resistors being used instead. The main smoothing condensers are in the amplifier chassis, as has already been mentioned, so that there is only one electrolytic on the power supply chassis, which holds the transformer and rectifier apart from the smoothing resistor.

The first thing to do is to tune the amplifier plate circuit to the oscillator, or vice-versa, whichever is most convenient. If the instructions have been followed, there will be no difficulty about this, and the two tuning slugs can simply be adjusted until adjusting one of them enables a peak to be tuned through. The best way of observing this is with a V.T. voltmeter, and since one will have to be borrowed or otherwise acquired in order to do the final setting up, there is not much point in detailing any alternative procedure with mock-up equipment. The voltmeter is connected to the plate of the EL84, and the 100 k. amplitude control is advanced slightly so that a signal of several volts is present at the plate. Then L_2 is adjusted for a peak in the indicated output voltage. The adjustment will, of course, be different according to whether or not the output cable is connected to the plate, because the capacity of the cable adds to the tuning capacity and alters the tuning. The only thing to check here is that the oscillator is working, and that the plate circuit of the amplifier can be tuned to it. If it cannot, then a readjustment of the oscillator frequency by means of the slug tuning L_1 will enable it to be accomplished. The

exact frequency of the oscillator is not critical, and the variation of a few kilocycles either way from the nominal 60 kc/sec. will have no effect on the performance of the recorder. In the erase circuit there are three tuned circuits, the two in the oscillator and amplifier, and the head circuit itself. The amplifier plate circuit is in parallel resonance, and the head is in series resonance with the 150 $\mu\mu$fd. condenser connected in series with it at the deck end of the cable. Fortunately both can be adjusted with little interaction. One reason for this is that the series-tuning of the head is very broad, with a Q of only 1.6 or so, so that the capacity to be connected in series is not at all critical. Similarly, its capacity does not depend on the capacity of the cable, so that differences in length will affect only the setting of the parallel-tuned amplifier plate circuit, as outlined above. The procedure to be followed for tuning the amplifier plate and the head circuits is as follows: First, connect to the amplifier chassis the exact length of cable it is intended to use, and attach the plug to be used at the deck end. Then, measuring the amplifier output at the plate pin of the valve, or on the other side of the 0.05 μfd. blocking condenser, advance the input control enough to give a reasonable reading on the voltmeter, and adjust the plate tuning slug for maximum output, indicating exact tuning to the oscillator frequency.

The next step is to plug in the cable from the amplifier, and attach the V.T. voltmeter to the hot end of the erase head. If the value of the series condenser is correct, the voltage measured at the head should be approximately 1.5 to 1.6 times that read at the plate of the amplifier. If it should not be, the indication is that the head has a different inductance from that of the one used in the original, although it is difficult to see why there should be much difference. If one wants to tune the head circuit very exactly, the best plan is to reduce the value of the fixed head-tuning condenser to zero, and instead to connect a section from a broadcast gang condenser in its place. This is then adjusted to give maximum output, indicating exact tuning. The variable condenser is removed, without altering its setting, and the capacity in use measured on a bridge. The required fixed capacity is then made up with silvered mica condensers in parallel, if necessary, and the combination is installed. In our case, the 150 $\mu\mu$fd. gave almost exact tuning of the head, and this value was settled for. If now the V.T.V.M. is returned to the amplifier plate, it may be found that a slight re-adjustment is needed to bring this circuit to exact resonance, owing to the head circuit not being exactly at series resonance. A final tweak of the slug tuning the EL84 plate circuit is all that is needed in this case, to complete the tuning up. The setting of the correct level of the erase current can now be done quite independently of the tuning controls, merely by adjusting the input control to the EL84. Before this is undertaken, however, the tuned circuit containing L_3 should be tuned up. This is done by setting the 100 k. variable resistor at about half rotation, and connecting the V.T.V.M. to the upper end of the L_3 tuned circuit. There will now be a considerable voltage present at the voltmeter, and L_3 can be adjusted, in conjunction with the variable padder, to tune the circuit right on the nose. At this point, the whole H.F. system is properly tuned, and it remains only to set the erase and bias amplitude controls to their correct positions.

SETTING THE ERASE AND BIAS LEVELS

For this purpose, the V.T. voltmeter is again used, not merely as an indicator, but to actually measure the amplitudes of these voltages at the heads. With all decks, whatever their make, information is provided on the approximate voltages to be obtained across the heads. With our circuit, it will have been noted that the setting of the input control to the H.F. amplifier affects both the erase head voltage, and that across the record/playback head. Thus, it is imperative to set the erase amplitude first, and then, leaving this control set, to adjust the bias voltage. For a start, then, the 100 k. bias control resistor should be set at about half way, after which the V.T. voltmeter should be connected across the erase head. The input control to the EL84 is then adjusted to give 125 volts indication on the meter. If some recorded tape is available, the material on which can be dispensed with, it is now possible to try the effectiveness of the erasure. The erase head's excitation depends partly on the type of tape used. For instance, modern high-coercivity tapes require a stronger erasing field than earlier low-coercivity types, so that it may be found that incomplete erasure takes place with the type of tape it is proposed to use. If this is so, the effect should be tried of raising the voltage at the erase head to 150, but it is doubtful whether this will be required. Another reason for incomplete erasure is sometimes that the tape has been recorded at much too high a level. In this case there may be a trace of modulation left after passing the tape through the erase head, but this does not necessarily mean that there is not enough excitation for the head. If a second go through the erase head completely removes the modulation, and if a normally modulated tape is erased with one passage through the head, then there is enough voltage across the erase head.

In the case of the deck used by us, and illustrated in the August instalment, it was found that for BASF tape, which is a high coercivity type, we required only 130 volts, as against the 125 recommended by the makers of the deck.

Finding the best bias voltage, however, is slightly more complicated. This is more dependent on the make of tape than is the erase head voltage, but it is not particularly critical, and one can set the bias level quite satisfactorily without recourse to such aids as distortion-measuring equipment. The procedure is as follows: A tone, about 2000 c/sec., is obtained from either an audio oscillator or a frequency record, and is applied to the input of the record amplifier. The sensitivity control for the magic eye indicator is set fully clockwise, and the gain control is set so that the deflection of the outer edge of the shadow is only about a quarter of an inch. This will ensure that the audio input level is well below the maximum that the tape will accept, because it is essential to set the bias level with a signal input that cannot possibly overload the tape. Then, with this input setting, short lengths of tape are recorded with a number of different settings of the bias control, from minimum up. When these are played back, it will be noted that as the bias increases, so does the output level on the playback increase also, even though the audio input has not been altered. Eventually, a point is reached where further increase in the bias causes no further increase in output level. This is very near the optimum bias setting for the tape concerned. It has

been found by means of careful measurements, that when the bias is increased further, there is a slight reduction in distortion, and a slight improvement in signal-to-noise ratio, but these are by no means large enough to be detectable by the unaided ear. Accordingly, the best way of setting the bias level is to observe the value of bias at which the playback output ceases to increase, and to set the level to a slightly higher value.

SETTING THE MAGIC EYE SENSITIVITY

All that now remains to be done is to set the sensitivity of the magic-eye level indicator. This involves finding the maximum input level that can be applied to the input of the record amplifier without overloading the tape, after which it is only necessary to adjust the eye sensitivity control until the shadow just closes. Finding the maximum input is also best done with a tone input, and again, 2000 c/sec. from an oscillator or frequency record is the best signal to use. The procedure is to record a few seconds of tape with a known setting of the input control, and then to record further pieces with progressively increased settings. If the V.T. voltmeter is available, the best way is to connect it to the plate of the ECC83 section which feeds the magic eye rectifier circuit. Then the first piece of tape can be recorded with a small but readily observed deflection of the meter needle. Thereafter, the input is advanced in equal steps, as indicated by the meter. The record is then played back, and we now have the job of deciding which step gives the maximum distortion that can be tolerated. This is easier if an oscilloscope is available with which to observe the waveform at the same time as listening tests are carried out, but the scope is by no means essential, as it is relatively easy to tell when audible distortion sets in. This scheme may seem somewhat hit-and-miss, but it really is not, because we are performing the test with a tone, distortion of which can be heard much more readily than it can when we are listening to music or speech. Thus, if our ears tell us that distortion on tone is just audible, at a certain level, we can be fairly sure that music, which is only allowed to reach this same level on the largest peaks, will sound undistorted.

When the maximum level has been decided upon, a tone input at this level is fed to the record amplifier, and the magic eye sensitivity control is set so that the shadow just closes. There after, the closure of the eye can be taken as the peak input level, above which distortion will be introduced.

CHECKS ON MUSIC

Having got as far as this, the proud builder will certainly wish to record some music, and see whether his recorder really performs as we all wish it to. The best way to do this is to make a tape recording of some of one's best-loved and best-known records, under conditions such that a true comparison is obtained between the original record and the re-recorded version. Then, if the tape version is almost indistinguishable from the original, the recorder can be given top marks, and can be used to take one's favourite tunes "off the air" with the knowledge that the reproduction will be as good (or as bad) as the tuner is capable of turning out.

To carry out a music test like this, one should preferably use the same pick-up equalizing circuits as are used in the record playing equipment that is always used for listening purposes. If a record is played with a particular setting of the variable tone controls, these settings should also be used for playing the record into the recorder. Sometimes it might be difficult to know the best point in the amplifier circuit from which to take the output to the recorder. If all else fails, the best plan is to take leads from the speaker terminals. If the amplifier is a very good one, the distortion will be very low, and since the record amplifier is quite sensitive, it will not be necessary to play the record at a high level in order to get enough output for the record amplifier. If a separate pre-amplifier is used ahead of the main amplifier, it is a good plan to take the output of the pre-amplifier to the recorder and at the same time to the power amplifier. The main thing in choosing a connection, is to use a scheme that does not cause either hum pick-up on the lead, or high frequency loss. For this reason, coming off the voice-coil winding of the output transformer has much to recommend it, provided that the amplifier is run at a low level to minimize distortion. The maximum input to the record amplifier as originally built was 90 millivolts, which figure can act as a guide to those who may have access to known audio voltages. This refers of course, to the high-level input terminal, and thus does not take into account the gain of the microphone pre-amplifier stage. However, this figure should be taken as a guide only, and the test described above should be carried out independently for every individual recorder.

The End.

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Public Address

THE 100-VOLT LINE SYSTEM OF AUDIO DISTRIBUTION

Coming into much more widespread use at present is the 100-volt line system of feeding loudspeakers in large or small numbers from high-powered P.A. amplifiers. In some ways, the method is such a startling departure from conventional practice that technicians sometimes have difficulty in understanding how it works. This article explains the system, and some of the things that can be done with it.

INTRODUCTION

In public address installations, problems arise that have no counterpart in any other branch of audio activity, and perhaps the most vexed of these is the question of feeding multiple speakers. By a P.A. installation, we mean any hook-up, either permanent or temporary, in which a large number of speakers have to be fed from a single large amplifier, and in which the loading on the amplifier is likely to vary widely from time to time. It is often necessary, for instance, for only one small speaker to be excited, and for others to be switched in during a programme, without a break in the continuity. Under these conditions, the switching must be done in such a way that bringing in additional speakers has no effect on the power fed to those already on. Similarly, if some speakers have to be switched off, it is undesirable for increased power to be fed to those remaining. In the past, this problem has usually been tackled by designing the output transformer with one secondary winding for each speaker, or group of speakers. The speaker switching is then arranged so that when one is cut out of circuit, its place is taken by a dummy load, in the form of a resistor capable of dissipating the power used by the speaker. In this way, the load on the amplifier remains constant, and the power fed to the other speakers does not change. While excellent for a permanent installation, such a scheme is not at all flexible. The amplifier is at all times delivering its maximum power output, whether half a watt or fifty are being used. Also, unless speakers are grouped together (and this is inconvenient or even impracticable), the lines that must be run from the amplifier to each speaker must be of heavy gauge, for speaker impedances are low, and line currents correspondingly high. For temporary installations, the idea is very inflexible indeed, and other schemes are used, such as using series-parallel arrangement of the speakers, all of them having the same impedance. This is more flexible, but it still does not allow differences in the powers fed to the various speakers to be readily controlled. It was to obviate much of this inflexibility that the 100-volt line system was invented and brought into use.

THE 100-VOLT SYSTEM

In this system every amplifier is provided with an output transformer which gives an output voltage of 100 when the amplifier delivers its maximum rated power. For example, a 10-watt amplifier, when fully loaded would produce 100 volts of audio at the output terminals, and so would a 100 or a 50-watt amplifier. The amplifier is then regarded as a generator with an output of 100 volts, and the assumption is made that this 100 volt output does not change, provided that the load is not so heavy that the rated output of the amplifier is exceeded. Now in this discussion, the output of 100 volts refers to the full power output of the amplifier. Quite obviously, the actual voltage will fluctuate as the signal varies, but the maximum output, which occurs when the output valve just starts to clip the signal is the 100 volts referred to. It is best to imagine that the amplifier is being fed with a sinusoidal signal so that the output is 100 volts R.M.S., whether or not any load is connected across the output terminals.

Now although looking at the amplifier in this way may be somewhat novel, it is worth noting that we habitually regard the A.C. mains in this same way. The mains, we say, give us 230 volts, and provided that the load we connect to them does not overload the wiring, we can draw unlimited power from them, without the voltage dropping at all. We rate our lamps, toasters, motors, and what you will, by the number of watts they consume, and not by their impedance. Suppose we have a mains circuit in which there is a 5-amp fuse. This fuse sets the maximum power that we can draw from the circuit and if we liked, we could rate the circuit at $(5 \times 230) = 1150$ watts. We then do not worry directly about the impedance of the devices we connect to the circuit; we merely add up the total wattage, if several things are connected to the circuit at the one time, and as long as they do not add up to more than 1150 watts, we are O.K.

With an amplifier working on the 100-volt system, the output transformer has the correct turns ratio to give this 100 volts, and the amplifier is designed, by the use of feedback, for example, so that with no load connected to the output terminals, the output voltage is 100 volts when the gain control is properly adjusted. If this is done, we can hang loads of various wattages across the output terminals until we are drawing off the rated power output of the amplifier. This time, we do not have a fuse to tell us when to stop. Instead, the amplifier just refuses to deliver more power than it is able to do, so that fuses are unnecessary, but the principle is exactly that of the mains outlet with a fixed wattage rating, and the appliances, each with its own wattage rating, all connected in parallel to the output terminals.

HOW ABOUT THE SPEAKERS?

So far, so good, but what about the speakers? Well, these are rated in watts, too, but this is just a maximum rating, and we by no means want to run them

(Continued on page 31)

The PHILIPS Experimenter

An advertisement of Philips Electrical Industries of N.Z., Ltd.

No. 108: AN OUTSTANDING PHILIPS RADIO-GRAMOPHONE

INTRODUCTION

Readers of these pages will no doubt think it a most unusual departure on our part to make a domestic radio-gramophone from the Philips range the subject of the "Experimenter". We agree, wholeheartedly, but the last thing we propose to do about it is to apologise, for the "Carnegie Hall", as the model is named, is really an outstanding piece of work, from all points of view. Accordingly, the description of its design features is a technical story which we are willing to wager is no less interesting than many of the articles that have appeared under this title.

PACKAGED HIGH-FIDELITY

The "Carnegie Hall", of which this article is a technical preview, since it is not yet released on the New Zealand market, is Philip's answer to the often voiced complaint that high-priced radio-gramophones should give high-quality reproduction of records and radio programmes, but don't. It has been designed to have everything that previous radio-gram. combinations possess, and to be capable of high-fidelity audio performance as well. And yet, it is a self-contained instrument, with properly designed speaker enclosure built in—truly the embodiment of packaged hi-fi.

At this stage, we might be giving the impression that this is "just another radio-gram", but nothing could be farther from the truth, as anyone who stays with us for the next two pages will soon realize.

NO OUTPUT TRANSFORMER

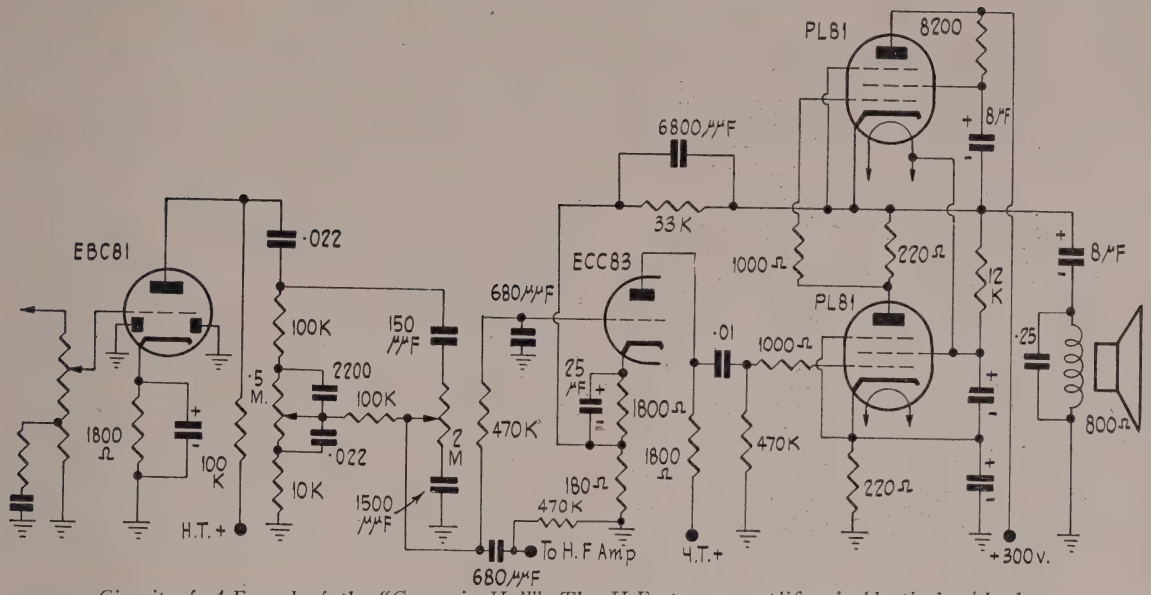
Since the greatest technical interest centres round the audio section of the "Carnegie Hall", we propose to describe this portion of the instrument first, and perhaps the most notable departure from conventionality in its design is to be found in the fact that it does not use an output transformer! The circuit diagram of the audio section is given in full in Fig. 1, where it will be seen that not only are there no output transformers, but that there are four output valves! But it is time we stopped talking in riddles, and having, we hope, whetted readers' appetites, got to the root of the matter, going through the circuit, in the approved fashion, backwards.

There are two speakers, both specially produced in the Philips Eindhoven factories. One is a ten-inch woofer with a very low free-cone resonance of 30 c/sec., and the other is a dual-cone, single voice-coil unit handling the middles and highs, up to a top limit in the vicinity of 20,000 c/sec. As is usual in high-quality audio systems, the purpose of using two speakers in this way is to reduce distortion, and so make possible the useful extension of the frequency range over the whole audio spectrum. Here, the same principle has been extended to the output stage of the amplifier. In any amplifier, however good, the greater proportion of the residual distortion occurs in the stage which handles the greatest signal voltage—the output stage. The best-known method of reducing this distortion is to use heavy negative feedback round the output transformer, the output valves, and most of the voltage-amplifying stages. Feedback from the secondary of the output transformer reduces distortion which occurs in the output transformer as well as in the valve circuits themselves. In this set, however, distortion in the output stage is minimised both by the use of negative feedback, and by limiting the frequency range applied to the power amplifier valves. In other words, a frequency dividing network is placed in front of the output valves instead of after them, and two entirely separate power amplifiers are used as well as two speakers, thus reducing still further the possibility of the introduction of intermodulation distortion. And, since there are no output transformers, distortion from this source is entirely eliminated.

ALL IN THE SPEAKERS

The ideas that have been set out above are admirable ones, which have no doubt occurred to many amplifier designers, but the last, and most startling feature in particular, would not be possible were it not for the very special loud-speakers used. These, believe it or not, are wound with voice-coils of 800 ohms impedance. To those with any knowledge of the manufacture of speaker voice-coils, this will appeal as a very considerable technical feat, as it undoubtedly is. The wire used is only 7.5 microns in diameter (one micron is 0.0001 cm.) and is specially drawn to this almost incredible fineness by a special diamond die just a few inches away from the former, on to which it is wound as it is drawn. The insulating material is sprayed on to the wire as it is laid on the former by the winder. It was found necessary to go to these lengths in order to make such a high-impedance voice-coil possible. For instance, attempts to use enamelled wire made by conventional methods failed. because the tolerance on the diameter of the wire could not be held close enough during manufacture of the wire. It might reasonably be expected that the winding of a multi-layer wave-wound voice coil, with even the finest wire, would necessitate the use of a much wider than usual magnetic gap, which would result in greatly decreased efficiency, but in point of fact, these speakers have been found to have an output only 1 db. down on that of an exactly similar speaker with a conventional low-impedance voice-coil.

Another interesting feature of these speakers concerns their damping. It might be expected that a high-impedance speaker would have very poor electrical damping, because even if it is fed from an amplifier with zero output impedance, there still remains the impedance of 800 ohms. This problem



Circuit of A.F. end of the "Carnegie Hall". The H.F. power amplifier is identical with the L.F. one, and uses the other half of the ECC83, and two further PL81s to feed the separate H.F. speaker.

has been attacked by the addition of a copper ring which encircles the end of the pole-piece, and acts as a short-circuited turn magnetically coupled to the voice-coil winding. Thus, the back E.M.F. generated by the movement of the voice-coil causes heavy current to flow in this ring. The current reacts back on the voice-coil in such a way as to oppose the original motion, thereby heavily damping the voice-coil.

Having designed and built such speakers, there remains the problem of feeding them from an amplifier, without the use of output transformers. If conventional circuits were to be used the difficulties would be very great. For instance, a Class A push-pull amplifier of the ordinary kind requires a plate-to-plate load impedance of at least four times the plate resistance of each valve, so that if an 800-ohm speaker were to be used, the output valves would have to have the phenomenally low plate resistance of 200 ohms or less, and such valves do not exist. About the nearest approach is the American 6AS7G. with a plate resistance of 800 ohms, but this is still far too high. In addition, the conventional push-pull circuit would require a centre-tapped voice-coil winding, and this would not make the speakers any easier to build.

Fortunately, however, a relatively little-known circuit exists which has just the characteristics required. In it, the valves are in series, so far as the D.C. plate supply is concerned, but from the A.C. load point of view, they are in parallel. This is exactly the opposite of the usual push-pull circuit, where the valves are in series with respect to the load, but in parallel to the D.C. plate supply. Also, in the ordinary style of push-pull amplifier, the load impedance is twice that needed by a single tube. In this circuit, the figure is one half the single-tube value. The point from which the output is taken is the plate-cathode junction of the two tubes, which are fed, like any other push-pull stage, in anti-phase on their control grids. This being the case, the plate current of one valve must increase at the same time as that of the other decreases. At first sight, this would seem to be impossible, as the two are in series, and at all times, the current drawn from the supply is constant, but the answer is to be found in the load, which is coupled through a large electrolytic condenser. Image, for example that the D.C. plate current of both valves is 100 ma. A small signal applied to the grid of the lower one causes its plate current to swing from, say 90 ma. to 110 ma. Now if the upper tube is driven, as we have assumed, in anti-phase, it must draw 110 ma. at the same time as the lower one is drawing 90 ma., and vice-versa. But how can this happen if the two tubes are in series? The extra 20 ma. current in the upper valve cannot flow to earth through the lower valve, and so must do so through the load. It can be seen, therefore, that driving the valves in anti-phase causes a peak current swing of 10 ma. in each valve to send a current of 20 ma. through the load impedance. On the opposite half-cycle, when the upper valve draws 90 ma. the lower one 110 ma., the extra 20 ma. must flow through the load in the opposite direction. The question of how the upper tube is excited is not as difficult as might seem at first. The 220 ohm resistor between the cathode of the upper valve and the plate of the lower one acts as a bias resistor for the upper one, and at the same time, being unbypassed, provides the excitation, because the control grid of the upper tube is returned to the lower end of the resistor. Altogether, the circuit is a most interesting one, and it is a pity that we have no space in which to enlarge on its properties and qualities. However, enough has already been said to indicate why the load is half that for one tube, and why the arrangement can be called in somewhat Irish fashion, a "single-ended push-pull" one.

Negative feedback is taken from the output terminal of each power amplifier to the cathode of its own separate voltage amplifier. Slight differences may be noted here, such as the 6,800 μμfd. condenser across the feedback resistor of the upper (low-frequency) one, and the small coupling condenser to the input grid of the high-frequency one. In the grids of the ECC83 sections can be seen simple low- and

high-pass RC filters, which give a gradual cut off to each amplifier above and below 400 c/sec., respectively. The filters are fed from a tone-control network giving independent lift or cut for bass and treble. This network has a considerable insertion loss, which is compensated by the preceding EBC81, in the grid circuit of which is the volume control.

OTHER FEATURES

The revolutionary A.F. end of the set is not the start and finish of it, by any means. The tuner section, using the latest Noval-based valves, gives bandspread all-wave reception up to 20 mc/sec., and itself has some very unusual features. The I.F. amplifier, for instance, has continuously variable selectivity, control of which is ganged with the treble control in the audio section, so that the user does not have an additional and unfamiliar control to cope with. A highly efficient Ferroxcube rod aerial is used, which can be set in the optimum position for reception irrespective of the orientation of the cabinet, while there is provision for using an external aerial without upsetting the tracking of the R.F. circuit. A specially designed gang condenser is used which gives tracking at four points on the broadcast band instead of the more usual three, and with greatly reduced tracking error in between the tracking points.

The bass speaker is baffled in a properly designed totally-enclosed, or "infinite" baffle, which employs a new and very effective type of sound absorbent to deaden resonances, and gives excellent response down to 40 c/sec. There is provision, too, for installing a new high-quality Philips tape deck, which can be bought as an extra and slipped into its compartment and connected up in less than two minutes. Altogether, then, the "Carnegie Hall" is a remarkable piece of design, for which the chief designer, Mr Murray Allardyce deserves top marks. For one thing, although this instrument is in the upper price bracket, it costs little or no more than many radio-gramophones that have been put on the market with vastly inferior performance. At last, here is a machine that may well make the quality enthusiast think twice about assembling an outfit from separate amplifier, turntable, speaker, etc., after which he still has to worry about getting expensive cabinet-work specially built.

Space precludes us from listing many other features of the "Carnegie Hall" here, but we hope that what has been written will serve to dispel the idea that New Zealand manufacturers are not interested in producing equipment that embodies the latest technical advances.

N.Z. Radio, Television, and Electrical Traders' Association Annual Report

In general, the industry has flourished, states the Annual Report of the New Zealand Radio, Television and Electrical Traders' Association, presented to the Annual Conference held at Wairakei on 8th September. "Trading conditions have been good, but the individual trader has had greater costs and has had to work hard to maintain his position." However, many anomalies have been overcome during the past year.

Increased activity on the part of country groups has been quite a feature this year, and it has been encouraging to note the greater interest of traders generally in the work of the Association.

A new Constitution has been prepared which allows for the formation of two autonomous groups within the Association. Under this scheme, retailer and wholesaler groups will each have their own chairman and executive, and will meet separately. A Board of Directors elected by both groups will control those items which govern the overall finance of the Association, and matters which concern the property, assets and employees of the Association. The Board will have equal representation from both groups, and will have as its chairman the President of the Association, who is to be elected at each Annual General Meeting.

Industrial Matters

"The radio apprentice today has everything in his favour," states the Annual Report. It is hoped that the Association can help to increase the number of registered servicemen engaged in the industry, so that more suitable educated boys can be brought into the radio trade. Mr Ron Waddell of the Seddon Memorial Technical College was commended for his work in the educational sphere.

Television

Regret concerning the continual shelving by the Government of the television problem was forcibly expressed in the annual report. The Association will continue to press for the institution of such a service under either Government control or that of private enterprise. Again, Mr Ron Waddell of the Seddon Memorial Technical College was commended for his work in the training of future TV technicians and the operation of the experimental transmitter at the College.

Condensers

At last success has crowned the efforts of this and other Associations to have the import restrictions removed from condensers. It is felt that the wider range of condensers now available will led to better radio design and performance.

Registration of Radio Servicemen

To absorb the many prospective apprentices awaiting employment, the Association advocates that experienced radio servicemen should be given at least limited registration. To a degree, such a system is in operation already, and registration of applicants with a certain experience is being favourably considered by the Registration Board, with the help of the Dominion Apprenticeship Committee. Alternative examination qualifications are also considered, and individual servicemen are urged to apply for registration as soon as possible. After Christmas, 1956, registration will be given only to those who have served the necessary apprenticeship under a registered man, and who have, in addition, passed the qualifying serviceman examination.

Power Board Trading

Following representations to the Minister of Finance on the subject of Power Board Trading, the Association has been advised that having regard to the present extent of such trading, the Government considers there is no immediate necessity for action. Members are urged to watch the position closely and report any increase in such trading which affects them, so that further representations can be made to the Government, if necessary.

Group Insurances

Insurance generally can be a big expense to a Dealer, and many members of the Association have taken advantage of the group insurance scheme launched by the Executive. It is a scheme well worthy of support, and is commended to interested members. Inquiries should be addressed to the Association's Secretary, Mr J. E. Beachen, P.O. Box 611, Auckland.

Mark-Up and Margins

The report expressed satisfaction with the general increase in mark-ups and margins without the loss of quality of the items concerned. Appreciation was recorded of the co-operation of manufacturers and agents in this matter.

Stolen Radios

Members are urged to report stolen items immediately so that adequate publicity can be given to this matter and every effort made to assist the police to recover same.

General

Concluding his report, the President, Mr W. J. Murphy, expressed his appreciation of the work of the Vice-Presidents, the

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100-Volt Line Distribution

(Continued from page 27)

at maximum input all the time. Take the case of a factory installation, for example. The P.A. system is being arranged so that each room that requires a speaker has one, or more, according to the distribution requirements for the resulting sound. We come up against the problem that in a quiet room, a quarter of a watt may well be enough power, whereas in a noisy assembly room, some 20 watts may be needed, distributed over three or four speakers. Suppose, with our experience in these matters we have gone round and totted up the total power requirement, and found it to be 47 watts. Obviously a 50-watt amplifier is called for, and we now have a list saying that in one place we need half a watt, in another ten, in yet a third, two watts, etc. We then provide an amplifier which has an output transformer calculated to deliver 50 watts at a voltage of 100 R.M.S. across its output terminals. All we need now are the loudspeakers which will consume half a watt, ten watts, two watts, etc., when connected to a line on which there exists a signal of 100 volts R.M.S. This way, the amplifier delivers at any one time only enough power to feed the loads that are connected to it, its voltage regulation being such that even if all loads are removed, the voltage on the output line stays at 100 volts.

How, then, do we organize a speaker, so that when we connect it to the 100 volt line, it draws, say half a watt, and no more? We obviously cannot connect an unspecified number of 4 or 15-ohm speakers across the 100 volt line to get the desired result. The answer is that a transformer is used at each speaker. Its turns ratio is adjusted **so that the impedance of the speaker is stepped up to that value which, when connected across 100 volts, draws from the amplifier the required power.** Note that it is only at this late point in the discussion that speaker impedance has had to be mentioned at all. And this is only because speakers are always rated in terms of maximum power input, and impedance. They could just as easily be rated in terms of voltage. For instance, a 15-ohm speaker rated at 15 watts, could just as easily be called a 15-volt, 15-watt speaker, or one of 4 ohms rated at 2 watts could be called a 2.8-volt, 2-watt speaker. With this sort of rating, the calculation of the individual speaker transformers would be very easy. For instance, if one of the speakers in our imaginary installation is to receive 2 watts, and its impedance is 4 ohms, it will need to receive 2.8 volts. Since the line voltage is 100, the transformer must have a step-down ratio of 100/2.8, or 35/1. If this is done, 2.8 volts will actually appear at the voice-coil terminals when there is 100 volts across the 100-volt line, and the speaker will be drawing 2 watts from the amplifier.

Now let us look at this transformer from the conventional point of view. Its step-down ratio is 35/1. Its impedance ratio is therefore $35^2/1$, or 1,225/1. Thus, the impedance seen looking into the input terminals of the speaker transformer is (1,225 x 4) ohms, or 4,900 ohms. Thus connecting the speaker to the amplifier's output line in this way has placed a load of 4,900 ohms across the line. If the same procedure is followed for all the speakers to be connected, it will be found that the loads presented by the various speaker transformers, when all connected in parallel at the amplifier terminals, will amount to the correct impedance to terminate the amplifier at full load. This is because the whole thing has been worked out on the basis of adding together powers, which is a much easier thing to do than working out the values of impedances in parallel.

MATCHING?

At this point, we can hear numerous people murmuring "What about speaker matching, and what about amplifier matching, too?" At first, it does look as if matching had been completely ignored, at least as the term is generally understood. As far as the individual speakers are concerned, it certainly cannot be said that they are matched to the output valves of the amplifier, in the ordinary sense of the term, because this usually implies that the matching is such that a single speaker acts, through the single output transformer, to present the amplifier with that value of load impedance which allows it to develop maximum power, if the gain control is advanced far enough. The speaker is not interested in how the voltage is applied to its voice-coil. If, by any means, whatever, the voltage required is developed at the speaker's voice-coil, it can be said to be matched, and in this sense, the 100-volt line system does match the speakers.

Where matching is not employed, is at the amplifier output, **except when all loads are connected.** We are able to do this, because we have assumed a special kind of amplifier, namely one with good voltage regulation or, which is the same thing, low output impedance. This is what is meant when we say that disconnecting some or all of the load will not result in a large increase in output voltage. Thus, the amplifier cannot use tetrodes or pentodes without feedback, if the load is to be highly variable, unless negative feedback is also used. Triodes without feedback (except Class B stages) can be regarded as having a constant-voltage output for the purposes of this kind of loading.

Before we leave the subject of matching, we should perhaps say a little about the amplifier output transformer, and what sort of turns ratio it needs, if it is to turn the amplifier into one with 100-volt output. Suppose, for example, that the amplifier is rated at 50 watts output. The transformer is then required to match the output valves to a load which draws 50 watts at a voltage of 100. It will be noticed that this is merely an alternative way of expressing the load impedance at the secondary of the output transformer, for if the voltage and power are specified simultaneously, the current drawn and also the impedance of the load circuit must be fixed.

In our example, we have that $50 = 100^2/R$, where R is the load resistance. Thus, $R = 100^2/50 = 200$ ohms. We must therefore give the output transformer the right turns ratio to match the plate-to-plate load required by the ouput valves, to 200 ohms, and this can be found in the ordinary way.

WHAT HAPPENS WHEN THE AMPLIFIER IS PARTIALLY LOADED?

It should be obvious by now that unless the full load (i.e. all speakers) is connected, the actual impedance presented to the output valves will be higher than that required for maximum output. This means

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For the Amateur

RECEIVING SINGLE SIDE-BAND

Last month we produced a dissertation on the virtues of single sideband transmission, and showed in particular how a given number of watts in the aerial provides the same effective signal at the receiver, as a conventional A.M. transmitter of approximately eight times the power output. Alternatively, one can obtain results equivalent to those from a given A.M. transmitter by using an S.S.B. transmitter of an eighth the power rating.

We also showed how this fact can be made use of in order to effect considerable economies in equipment and therefore on monetary outlay, especially when it is not a case of scrapping existing modulation equipment. Last month's article, however, made no mention of the receiving end of the system. This must obviously be taken into account, because even if one has no detailed knowledge of the technicalities of S.S.B. transmission and reception, it would seem apparent that a signal which differs so markedly from an ordinary A.M. one should need special means for making it intelligible at the receiving end.

USING AN ORDINARY RECEIVER

This is quite true. Fortunately, however, there is no reason why an ordinary communications receiver cannot be used for S.S.B., provided only that its performance in one or two important respects is good enough. Special equipment is needed if the greatest advantage is to be taken of the possibilities of S.S.B., but it is by no means essential. Thus, one can sample the joys or otherwise, of S.S.B. reception without the expenditure of anything more than the time necessary to find and tune in an S.S.B. signal.

If this type of signal is received in the usual way, the result is quite unintelligible. The reason for this is to be found in the mechanism of the ordinary detector, which in order to function, must have a carrier present as well as the sidebands. A single sideband together with its carrier CAN be received in the usual way, and unless measurements were taken, it would not be possible to tell whether the signal was an S.S.B. one or a normal A.M. one. The only difference between the two would be that the signal consisting of carrier and one sideband would give half the audio output from a given carrier voltage that would be obtained from the full double-sideband signal having the same carrier amplitude.

If a single sideband, without carrier, is to be received on a conventional receiver, it is necessary for the missing carrier to be supplied artificially. This can be done by the simple expedient of turning on the B.F.O., as for C.W. reception, and tuning it to the exact frequency that would be occupied by the carrier if it were not missing from the transmission. If this is done, the detector will be unable to distinguish the artificial carrier from a "natural" one, and the audio frequency output will be identical with the desired modulation. But if the artificial carrier is not tuned to the right frequency, some rather unusual results will be obtained. Let us consider for a moment how a diode detector works. The usual rectification method of explaining it is quite satisfactory for many purposes, but for this one, a different type of explanation of detector action is preferable. It is well known that if two frequencies are applied to a non-linear device, such as a diode, a distorting amplifier, or what you will, the output from that device contains new frequencies. These are the harmonics of the original frequencies, together with sum and difference frequencies. If we go back to our simplest possible signal, namely one representing a simple 1000-cycle tone modulating the transmitter, our S.S.B. version will consist of a single frequency. Obviously, if this signal is passed through a conventional diode detector, the A.F. output will be zero, because the signal is indistinguishable from an unmodulated carrier, because the two signals are identical in kind. But when we turn on the B.F.O., and tune it to a frequency exactly 1000 c/sec. away from the I.F. signal in the receiver, the detector's non-linear action produced sum and difference frequencies. The difference of 1000 c/sec. is the detector output, and is heard in the output of the receiver, while the sum frequency is by-passed to earth by the diode load condenser. If we have a more complex signal, the same B.F.O. procedure beats the I.F. components of the signal to their original A.F. equivalents, and the modulation is reproduced as we want to hear it. Now consider what happens if the artificial carrier is not quite right in frequency. The beating action will occur quite normally, but the audio frequencies produced will not have their correct values. If, for example, the re-inserted carrier is 100 c/sec. out of frequency, the audio frequencies will all be either 100 cycles low or high, and the result may still be intelligible, but it will be quite unnatural. Many writers have stressed the necessity for extreme accuracy in the frequency of the artificial carrier, saying that it must be within one or two cycles per second of the right figure if an intelligible result is to be obtained. This estimate is much too tight, however, for experience has shown that for intelligibility, a more realistic figure is plus-or-minus 50 c/sec. This order of accuracy in setting the B.F.O. is not difficult to attain at all. It must be remembered, however, that the stability of the whole receiver comes into the picture, for when the B.F.O. is set to a given frequency, any shift in the signal frequency will produce the same audible effect as a shift in the B.F.O. frequency. The stability of the signal frequency depends not only on the man who made the signal in the first place, but on the stability of the local oscillator in the receiver. It is obvious, then that successful reception of an S.S.B. signal requires a good receiver. One of the kind that needs only to be breathed on in order to shift the frequency of the I.F. signal will clearly be unsatisfactory for S.S.B. reception. Most people these days do possess good stable receivers, so that stability is not a very serious problem. This argument does bring out quite forcibly the need for good signal stability. It is quite useless to go for S.S.B. transmission unless the frequency stability of the crystal oscillator or V.F.O. is unexceptionable.

OTHER FACTORS AFFECTING THE RECEIVER

A very attractive feature of S.S.B. is that each signal takes up only half the space on the band that would be occupied by the corresponding A.M. transmission. It should thus be possible to accommodate twice as many S.S.B. signals as A.M. signals on the same band, with no increase in the mutual interference between signals—QRM for short. In practice, the advantage of S.S.B. is greater than this. If everyone used it, there would be no carriers at all on the band, and heterodynes between carriers would then be non-existent. In short, if you haven't got a carrier, and the man who happens to be 5 kc/sec. away from you hasn't got one either, someone who is reading your signal can't be troubled by a heterodyne between the two signals. This is not to say he won't get any interference at all, but such interference as there is will be of a transient nature—completely absent when the unwanted station is pausing for breath, and present only as an unintelligible kind of "monkey chatter" when he is modulating. This sort of thing is much easier to copy through than either a heterodyne, or intelligible speech interference, and because of the mechanics of S.S.B. detection, the QRM cannot possibly take the form of intelligible speech.

A further advantage of S.S.B. is that for a given range of reproduced audio frequencies, only half the bandwidth is called for in the receiver. This means that if the minimum necessary speech band is being transmitted, say, 300 to 3,000 c/sec., this can be centred on the pass-band of the I.F. amplifier, so that the carrier is right at one edge of the band. The skirt selectivity of the I.F. amplifier can be very high indeed, because there is no need for the pass-band of the I.F. amplifier to include the nominal carrier frequency, as this is inserted independently of the amplifier. In addition, a pass-band only 3,000 c/sec. wide will give as much intelligibility on S.S.B. as a pass-band 6,000 c/sec. wide with an A.M. signal. A consequence of this is that there is only half the possibility of picking up QRM that exists when the receiver has the minimum pass-band needed for A.M. This advantage depends on the receiver's being specially tuned up for S.S.B. reception, so that it will not be realized when variable selectivity is not available. Where it is, though, it means that the set can be used for S.S.B. with only half the A.M. bandwidth.

SELECTIVE FADING

A great deal of the trouble in copying 'phone signals over long distances is due to selective fading. The "singularly rapid unintelligible patter" produced on an A.M. signal when selective fading causes the carrier to disappear is of exactly the same kind as is produced by an S.S.B. signal when attempts are made to receive it without benefit of B.F.O. Now when the carrier is not transmitted, it cannot be lost on the way, and must be supplied at the receiver, as we have already described. When it is inserted in this way, it is not susceptible to fading, so that the major cause of distortion of A.M. signals by selective fading is eliminated, and it is found that a fading signal is much more readily copied under a wide variety of conditions when S.S.B. is used. This is not just theory, either. It occurs as a cold hard fact, and is the major reason why S.S.B. is so much used in long-range commercial radio-telephone circuits, such as the new one instituted by our own P. and T. Department a few years ago between here and the United Kingdom. It is found, for instance, that dual diversity with S.S.B. gives a better answer than A.M. with triple diversity, and this is really saying something, as anyone who has had experience of diversity reception will agree. In commercial applications, the transmitter economy angle to S.S.B. is not nearly so important as in amateur communications, and this again points to considerable advantages of S.S.B. in other directions, otherwise commercial circuits would not make such great use of the S.S.B. technique.

In the next article of this series, we propose to discuss the pros and cons of the different methods of generating an S.S.B. signal, and, of course, to give some explanation of how the various methods work.

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THE SPECS ARE THE PROOF — FOR BEST BUYS, BUY EICO.

RECORD TALK

by JOHN GRAY

Occasionally in the musical and entertainment world we encounter a case of "man bites dog", and are duly astonished when someone with a reputation in one sphere suddenly achieves distinction in quite another. Such reflection is prompted by the appearance of a ten-inch Philips record on which Mr Harry Secombe, one of the stars of the BBC's contentious Goon Show, throws off his motley and dons another—that of the fully fledged operatic tenor. Unlike some who have tried this sort of thing, Mr Secombe has the means to carry it out, and if you buy Philips P26211 you will possess very decently sung versions of the leading arias from "Tosca" and "Turandot"; an excellent record for playing to your knowledgeable friends, asking them to guess the singer. Then when it comes to piano playing that is tasteful and pleasant, the Bill McGuffie records are worth trying. P26225 contains the haunting "No Other Love" together with "A Sunny Day", while P26267 couples "My Foolish Heart" and "Memory". And while in the mood for melody you might well sample two Latin American numbers by the Trio los Paraguayos on P15506. The titles, "Alma Vibrante" and "Bajo el cielo del Paraguay" are rather a mouthful with which to confront anyone behind a record counter, but you should at least make a note of the number.

All these records are attractive and, in style, thoroughly conventional. But we must move with the times, and Philips are not disposed to neglect the more up-to-date trends in popular music. Two artists with an appeal for the younger generation are "all out" vocalist Frankie Vaughan and a brassy young phenomenon called Lillian Briggs. The gentleman, like one or two other Frankies, is quite uninhibited as he yells his way through "My Boy Flat Top", but shows he can moderate his vehemence in quite a pleasant song, "Stealin' ", both on P26214. As for Miss Briggs, who stuns us with "That's the Only Way to Live" and "Follow the Leader" on B23507, I note that she also plays a trombone and in her time has driven a truck and done a spot of welding. Another formidable Amazon is the queen of the gospel singers, Mahalia Jackson, who gives us "The Bible Tells Me so" and "A Satisfied Mind" on B21717. There is lots more from Philips; honky tonk piano from Digits Malloy (F37030), two nice tunes from the "Boy Friend" presented by Scott Ellis and the Varsity Draggers on P26177, Anne Shelton in "Seven Days" and "The Great Pretender" on P26122, and a bright instrumental disc from the well known Danish fiddler Svend Asmussen. His numbers are "The Poor People of Paris" and a perennial item with this school of violinist, "The Hot Canary" (P56154).

There are fresh stocks of some outstanding back issues from the Philips LP catalogue, mostly standard major works. These can stand comparison with any other versions available today, the Brahms violin concerto for instance (Isaac Stern and Sir Thomas Beecham on ABL3023) or the D minor piano concerto with Rudolf Serkin and Georg Szell on ABL3027. But Philips are alone in the field with one of the best of all chamber works, Schubert's E flat trio as played by Schneider, Casals and Horszowski on ABL3009, and their version of the little Mozart opera "Bastien and Bastienne", recorded in Vienna under John Pritchard, is a better proposition than the older one on Nixa.

All companies are concentrating on the issue of music from films, more now than ever before. In fact, they are so up to date in this respect that it is becoming quite usual for film "sound track" records to be available to the public before they have had a chance of seeing the films in question. This is an unsatisfactory state of affairs, I should think, rather frustrating to the record companies in the long run, for the real demand, if there is to be one, will come only after people have seen the film, not before. At the time of writing, for instance, hardly anybody will have seen "The Man with the Golden Arm", the sound track music of which has just been released by Festival on FR12-887. On the other hand, Danny Kaye's "Court Jester" has already been seen throughout most of New Zealand and the sound track recording is an excellent reminder of some of the funniest sequences ever put into a costume film, it gives also the added pleasure of a popular artist who really can both sing and enunciate. You may go back to a previous success of the effervescent comedian and remind yourself of "Hans Christian Andersen" which has been re-released by Festival on FR10-971. On the "Pete Kelly's Blues" sound track (FR12-889) you hear such singers as Peggy Lee and the great Ella Fitzgerald. There is a set of three 12-inch LPs by Bing Crosby, assembled under the title of "Old Masters". These are original recordings by the old master himself, attractively packaged and sold in a substantial box: an excellent way of preserving the best of Bing. The order number is FGL12-967/3, and there are nearly forty songs included, each of which is of course sung complete.

Some short eighteenth century chamber works have appeared on Festival 45 extended play. Heaven knows, there is now as much of that century's music as anyone could possibly want, but comparatively little is on this handy size of disc, and so these new releases are really a good idea. They should prove acceptable to people who like such music but find that a little at a time is sufficient. A violin sonata by Albinoni shares XP45-917 with a quartet by Alessandro Scarlatti: this latter piece is for the intriguing combination of block-flute, strings and spinet. A companion record (XP45-929) holds similar short compositions by Albinoni (another sonata) and by Vivaldi. More conventional in style, but still a rarity as far as the musical public is concerned, is an unknown Mendelssohn concerto for two pianos. The work was never published in the composer's lifetime and this performance was recorded from the manuscript copy. Mendelssohn's concertos for piano and violin have always been among the most beloved of classical works, and there is no reason why popularity should be withheld from this one in A flat for two pianos. Soloists and orchestra (Orazio Frugoni and Annarosa Taddei with the Vienna Symphony under the experienced direction of Rudolf Moralt) do everything possible to make this issue a resounding success (Festival-Vox APL7400).

Norman Wright and Co. of Auckland, have extended their Cetra series and have also issued a diversity of material under the general heading of "W and G Selected Releases". This includes a number of 45s for children, and some LPs that are intriguingly different, including for instance, a "Voodoo" disc straight from Haiti (WG-PMR149). There is a disc of Christmas carols by the Gabriel Singers, released well in time for the festive season (WG-PMR131) and a performance of one of the staples of light orchestral fare, Ippolitov-Ivanov's "Caucasian Sketches", played by the Austrian Symphony Orchestra under Kurt Woess, who has successfully appeared this year as orchestral conductor in Sydney and Melbourne (WG-LMR154). The Cetra 45s include two further discs extracted from this label's complete "Rigoletto" recording, and they impress me as highly desirable, for I doubt if the line-up of principal singers, Lina Pagliughi, Ferruccio Tagliavini and Giuseppe Taddei, could be bettered today for this particular opera. On EPO-0322 and 0323 are eight "highlights", including Rigoletto's two big monologues, two of the tenor solos, and two of the soprano-baritone duets. Finally, Cetra announce with a flourish (and, I hope, a full realization of the further complications they are introducing to a business which is already complicated enough) the appearance of the first seven-inch LP record. In other words, it looks like a 45, but plays at 33. I suppose we shall have to call it "extra extended play" or something of the sort. Its number is UP7-100, and it offers extracts from the new complete "Madame Butterfly" with Clara Petrella and Tagliavini. The contents are a portion of the love duet, an aria from each of the two principals, and the final scene of the opera. When you think of it, if all seven-inch discs had been made to revolve at LP speed in the first place, life would have been very much simpler for the whole industry and public.

HMV's popular releases are headed by the "King and I" record taken from the sound track of the excellent new film (Capitol W740) which features Yul Brynner, who was also in the original Broadway production. Deborah Kerr, of course, is provided with someone else's voice for her share in the musical numbers. The music is, generally speaking, on a less flamboyant level than some of the other Rodgers and Hammerstein productions, and superior to most musical comedy scores being written today, and once again the record is definitely for those who have seen the film. Philips, by the way, have a recording made by the cast of the London stage production, with Valerie Hobson and Herbert Lom in the lead (BBL7002). Among HMV's single popular discs are Perry Como's latest hit "Hot Diggity" (HR 10282), two Max Bygraves offerings, "A Good Idea" and "Davy Crockett" on HR10222, and "Lift Boy" backed by "Nothin' to Do" on HR10252, there are also Ray Martin's versions of the "Carousel Waltz" and "Port au Prince" on DNZ10036. There is little spoken humour on records today, hence you may care to sample the story of "Carmen" as related by Andy Griffiths (Capitol 3402). This is "Carmen" seen very much through American eyes, and the dubbed-in audience, at least, seems to find it riotous.

One of the most brilliant piano and orchestra discs we have heard lately comes in the form of HMV ALP1349, whereon

Shura Cherkassky, one of the most deft of today's pianists, plays two Russian concertos. Prokofieff's second, in G minor, seems to be a "first time ever" release, and unless I am mistaken its companion piece, the Shostakovitch concerto for piano and trumpet, has not been available since the old Eileen Joyce version. This is a most impudent and even vulgar piece of music, and in one's lighter moments it is quite irresistible, especially in the matter of the clownish trumpet part so brilliantly tossed off by Harold Jackson. There are few concertos which can make us laugh outright. This is one of them and it cannot be recommended too highly to all those who appreciate something novel, the more so as Cherkassky is in dazzling form and HMV have lavished their finest recording on him and the expert playing of the Philharmonia Orchestra under Herbert Menges.

There are not many operas by the better known composers which will fit comfortably on to a single record, but one is Puccini's little drama "Il Tabarro" ("The Cloak), and a desirable issue it makes. The story is brief and brutal, a tale of adultery and revenge among the inhabitants of a barge which plies the Seine between Paris and Rouen. The Rome Opera performance on ALP1355 is dominated by Tito Gobbi's powerful singing of the role of the barge master who discovers his young wife is in love with one of his own employees. A new soprano, Margaret Mas, proves to be a full blooded singer and the others in the cast are excellent. Much loftier sentiments are expressed in another single operatic disc, the second act of Gluck's "Orpheus", recorded from a Toscanini broadcast (ALP1357). This act includes the marvellous chorus of the Furies and the idyllic ballet music, and Toscanini's forces, with Nan Merriman in the role of Orpheus, ensure a most beautiful recording, so much so that we must regret it was apparently impossible to record the whole opera.

Something long overdue has just appeared, so successfully that we cannot help wondering why it should have been denied us for so long. It is a complete version of Stravinsky's first great ballet, "The Firebird", which for years has been represented only by a concert suite containing about half of it. Hearing it all, with the well-known excerpts in their proper sequence, we can appreciate what a landmark it was in 1910 when Stravinsky was comparatively unknown. Here was music of a complexity such as had never before been written for ballet, and its effect in conjunction with the fantastic story must have been overpowering. The performance is in the safe hands of Stravinsky's senior disciple Ernest Ansermet, with the Suisse Romande Orchestra. Decca have given it a recording both rich and wonderfully clear, enclosed in a fantastically designed cover which conjures up the exact atmosphere of this ballet (LXT5115). And while on the subject of Russian music, we must mention another equally fine record, LXT5119, of Sir Adrian Boult conducting two brilliant suites by Prokofieff. One is from his satirical opera "The Love of Three Oranges", the other is from the music written for the film "Lieutenant Kije", and both abound in piquant melody and dazzling orchestration.

For lovers of the music of the piano, and of the modern French school, there is a true feast in the complete piano music of Ravel, as played by Walter Gieseking on three Columbias (33CX 1350-2, the first being single sided and consequently "half price"). Included are four fairly large works, "Le Tombeau de Couperin" (complete on the single-sided record) "Gaspard de la Nuit", "Valses Nobles et Sentimentales" and "Miroirs". Together with the shorter pieces these make a most exciting programme.

Lovers of light opera will welcome a London International release of Planquette's famous "Les Cloches de Corneville" ("The Bells of Normandy") on two discs, TW9 1114-5. This was written at roughly the same time as the later Gilbert and Sullivan efforts, with which it has a great deal in common. It is not so many years since the melodious "Les Cloches" was being given by operatic societies up and down New Zealand, and many of the older folk will find the tunes pleasantly familiar. The "authentic" style of performance means we have to sit through a certain amount of French dialogue, of course, but it is not really excessive and there is sound sense in releasing a native performance of this essentially Gallic light opera. More exclusively for French scholars, because music plays no part in it, is a complete release of "La Dame aux Camelias", the famous Dumas play which inspired Verdi's "Traviata" and, nearer to our own time, Garbo's film "Camille". Its sale will of course be limited, but it is a symbol of the growing scope of recorded material that such productions are available here for those who want them (London TW91123-4).

There is little space in which to detail other welcome issues: perhaps a splendid coupling of Mendelssohn's "Italian" and Schubert's "Unfinished" symphonies should not be overlooked, especially as they are so well done by the Philharmonia Orchestra under the young Guido Cantelli (HMV ALP1325), and there is another souvenir of Mischa Elman, in a welcome and very economical coupling of the two favourite Beethoven sonatas, the "Spring" and the "Kreutzer", on Decca LXT5126. In these recordings his pianist is Joseph Seiger, who recently appeared with him in New Zealand.

BOOK REVIEW

"HIGH-FIDELITY CIRCUIT DESIGN" by Norman H. Crowhurst and George Fletcher Cooper. Publisher, Gernsback Library Inc., New York.

At the outset, this reviewer would like unhesitatingly to recommend this book to all those who may be interested in high-quality audio amplifiers. It has been written, say the authors in their preface, to fill the very large gap that exists between those texts which demand from the reader an extensive knowledge of mathematics, and those of a purely "how to do it" nature. In its style of presentation, it succeeds admirably. Both authors are well known on both sides of the Atlantic for their published articles in technical periodicals, and have the happy knack of not only knowing a subject thoroughly, but of being able to impart that knowledge to others.

However, the title of the book is somewhat misleading, in that it by no means deals with all the topics the title might lead one to expect. For instance, the reader will search in vain for any mention of gramophone records, their characteristics, and equipment for playing them. Similarly, tape recording does not enter the picture, nor do many other things that will occur to the seeker after high-fidelity. Of course, there is no reason why they should, other than that any audio frequency equipment can come under the omnibus heading of high-fidelity, should the authors so desire. It can be argued, too, that gramophone records are not **circuits**, which word does appear in the title, but the circuits that deal with their output are! But we must not enter into quibbles of this nature. The book contains a great deal of useful information on amplifier design, treated in a readable but satisfactory manner whatever one's point of view. Anyone of very moderate mathematical attainments and of average intelligence should be able to make a good fist of designing an amplifier from scratch if he has first read "Crowhurst and Cooper", as the book may well come to be called, after the manner of more pretentious texts.

If there is any real criticism that can be levelled, it is that the authors have not quite managed to get away from a magazine article kind of presentation. This shows up most in Part 2, where there seems to be no logical scheme which is followed. The chapters are each excellent in themselves, but there is no unifying thread. In other ways, the authors' background as technical journalists certainly accounts for the book's readability, and for the most part, lucidity. A book which should be on every audio enthusiast's shelves, and from which professionals and amateurs alike will be constantly culling ideas and methods.

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16 2/3 R.P.M. RECORDS AND RECORD CHANGERS

by RALPH SLADE

Of the 16⅔ r.p.m. record, two different varieties exist. The first one belongs to the talking book category. These are 16⅔ r.p.m. records with a groove very similar to the one used on ordinary micro-groove records. The playing time on each record face can be up to half an hour, because with ordinary speech large amplitudes are not likely to occur, and thus the grooves can be spaced very closely together. On speech wow is not much of a problem and so the relatively bad speech regulation at the low turntable speed is of very little consequence. These records can be played on conventional players, if they provide for 16⅔ r.p.m. Adaptors for use on ordinary players, which are in effect, a planetary drive put upon the turntable, can be obtained in the U.S.A. On this kind of record a spoken edition of the Bible has been made available and this seems to be the most successful enterprise in this line, but even there the success is strictly limited.

The reproduction quality offered by 16⅔ r.p.m. records with an ordinary micro-groove is always below that offered by 33⅓ and 45 r.p.m. micro-groove records. The wave lengths as recorded are reduced by the factor 2.7 with respect to 45 r.p.m. records, and thus a serious restriction of treble response is necessary to suppress tracing distortion. Even if the upper frequency range is reduced to 4000 c/s, tracing distortion is considerably higher than at 10,000 c/s on a 45 r.p.m. record.

To avoid this a record has been developed, the groove of which is about a factor 3 narrower than ordinary micro-groove records. In this way tracing distortion has been made comparable to that of 45 r.p.m. records. In this way it is also possible to put more music on the record and, in fact, a recording time of up to 45 minutes on each face of the record can be attained. It will be appreciated that with such a fine groove a **finer needle has to be used,** in fact, the tip radius that is necessary for such records, is only 7½ microns.

Reproduction quality records is not just a question of theoretical calculations. Factors which to a large extent escape calculation are the influence of irregularities in the grove surface and the distortion which the needle pressure causes upon the groove. It will be appreciated that with a finer groove and a finer needle, irregularities of the surface of the groove walls have a relatively larger influence upon the reproduction than with a coarser needle. It will also be appreciated that when the modulating amplitudes are reduced, such as is necessary with a finer groove and a slower speed, the influence of groove irregularities is further increased.

With normal micro-groove records a satisfactory compromise can be reached by making use of a special recording characteristic applying treble boost to get a satisfactory signal-to-noise ratio for the higher frequencies, without getting too much tracing distortion. The steps which would have to be taken with the very fine groove 16⅔ r.p.m. records to obtain a similar signal-to-noise ratio as at higher speeds, would lead to a modulation level which is higher than can be permitted on those records. Thus treble response has to be restricted even when lower signals-to-noise ratio and more distortion than with 33⅓ and 45 r.p.m. records are allowed.

Further, a disadvantage of the slow speed is the difficulty of maintaining the momentum of the turntable at a sufficiently high level to keep wow below 0.4%. This restricts the kind of music that can be recorded satisfactorily.

Another difficulty with records with a very fine groove is that the needle pressure should be reduced more or less in proportion to the reduction of stylus tip radius*. Even with a needle pressure of 2½ grams, the impression made by the stylus into the groove walls is larger with respect to the record amplitude than in the case of 25 microns styli on ordinary micro-groove records with a vertical needle force of 10 grams. This, of course, also has an unfortunate influence upon reproduction quality.

All these factors together do not mean that in the long run it will not be possible to make 16⅔ r.p.m. music records, yet it is difficult to predict, whether it is within the practical technical possibilities to achieve the present-day standard of ordinary micro-groove records with 16⅔ r.p.m. fine micro-groove records. In the meantime 16⅔ r.p.m. music records have only been introduced for one purpose, where quality of reproduction is not such a stringent requirement.

Such conditions are found in cars and therefore 16⅔ r.p.m. music records have been introduced for use with automatic record players in cars. The high noise level of the running car as well as the bad acoustics make a lower reproduction quality acceptable. For this purpose a special automatic record player has been introduced in a number of American cars.

This is a very special record player and even if a higher turntable speed could be incorporated into it, this would not work with 45 r.p.m. records, because the larger recorded amplitudes on this record would cause trouble with the pick-up and because this pick-up in any case would have to be equipped with an ordinary 25 microns needle. The present so-called 4-speed record changers will not permit the playing of 16⅔ music records, because a needle pressure of 2½ grams cannot be realised with this equipment, nor are they fitted with a 7½ microns needle. In fact, tone arms which trace the 45 r.p.m. records with a needle pressure of 3 grams are not suitable for the very fine groove of the 16⅔ r.p.m. music records. These special records are played with a special tone arm of a construction which is satisfactory on small records only, but less suitable when larger records have to be played. The present position is that the 16⅔ r.p.m. music records have been introduced for a very special and restricted market only. Furthermore 16⅔ r.p.m. talking book records would also appear to have a similarly restricted market.

As both types of records require different features in a 4-speed record-changer, it would appear to us that some caution should be exercised in popularising 4-speed changers at present.

THE SPECS ARE THE PROOF . . .
FOR BEST BUYS, BUY EICO.

*But see a paragraph elsewhere in this issue on this subject.—Ed.

ELECTRICAL AND TRADE SECTION

SERVICE—AND THE FUTURE

by G. WHITBY

(This covers the main points of an article printed in the "Wireless and Electrical Trader", Vol. 96, No. 1256, which might prove of interest and value to New Zealand readers).

INTRODUCTION

It is not unreasonable to prophesy that the days of that admirable pioneer, the dealer-cum-serviceman, are drawing to a close. Admittedly, there will always be happy exceptions to this rather sweeping statement, but these will do no more than prove the rule.

In Britain, even at this stage, with television the only radical change in the general run of service work, many dealers have found it better to employ a service engineer rather than tackle the job of fault finding and repair themselves.

It is a trend which will result in the downfall of those whose theoretical knowledge is shaky, even though their practical knowledge may be unsurpassed.

Nevertheless, the employment of trained staff and the acquisition of elaborate and expensive servicing equipment is likely to be a heavy drain on the resources of the dealer who is unable fully to exploit the potentialities of his service department.

Is there an acceptable alternative?

THE NEED FOR AFTER-SALES SERVICE

There is no need to emphasise the growing importance of after-sales service—even if the manufacturers omit to do so—for nowadays the public are not so eager to tinker about with their receivers, and it is fortunate for the trade that this is so. The layman who screwed down the trimmers because they were loose is happily only a memory of many dealers, and any suggestion that the public should try to "do it themselves" is bound to draw a deep shudder from those who usually have to clean up the mess, that is, sometimes shamefacedly, returned to them.

As radio receivers become more complex, the public will become even more reluctant to probe their apparatus if anything goes wrong.

This attitude should be encouraged by all concerned BUT it does bring a headache with it, because it means that any dealer who sells a TV or radio set (or, for that matter any item of electrical equipment) must be prepared to give full after-sales service if he is to make friends of his customers. It is short-sighted policy to sell receivers in the vague hope that they will be taken elsewhere to be serviced.

Furthermore, repairs must be successful, cheap and preferably speedy, with collection and delivery thrown in and possibly a loan set offered in lieu of the faulty one.

How far short each dealer falls of this ideal service —ideal for the customer and himself—only he is able to judge. The standards are high and, regrettably, after-sales service is still regarded either as a necessary evil—of a money-spinner—by many.

Basically, the problem is one of economics. First-class after-sales service is expensive if the dealer has only a small number of repairs every week—far more expensive than the service department that is kept fully occupied. As with many other things, the more work that a service department is given, the cheaper it is to run.

It is unlikely that **real** after-sales service can be given if the department is expected to show large profits. The latter should exist mainly in the goodwill of the satisfied customer who returns to make other purchases, and recommends the dealer to his friends. Lip service, it should be remembered, is always the cheapest and most profitable form of advertisement.

MANPOWER IN THE SERVICE DEPARTMENT

This is a vexed question these days. The housing shortage is one difficulty, because it immobilizes service engineers who are otherwise willing to change their jobs. A further difficulty is the current shortage of technicians due to the defence programme and the fact that electronics is becoming increasingly important in industrial processes, creating yet another field of opportunity for the first-class service engineer.

A third difficulty is that, whilst the remuneration may be good, the position of service engineer is usually a dead-end job—with no particular status—from which the man must move if he wishes to progress further.

Coupled with this, of course, is the undoubted fact that no engineer worth his salt will stay where he has to perform odd jobs around the place when there is no legitimate work for him to do. Unfortunately, dealers cannot afford to employ a highly paid engineer to stand around and do nothing, and even in his occasional employment as (say) a shop assistant, the dealer is paying highly for his services. (On these occasions the engineer would be better employed in building equipment or improving his department).

As a result, the work does not usually attract the career man who, only too often, regards the job merely as a stepping stone to better—and more interesting—things. Perhaps it is necessary at this juncture to point out that there are always exceptions. The dealers who employ them can consider themselves lucky.

THE ECONOMICS OF SERVICING

Already it has been mentioned that a service department should not be run with the idea of making a substantial monetary profit. Nevertheless, whatever attitude is adopted towards the profits, it is desirable to run it economically, because economy and efficiency frequently go hand in hand. The expenses —or debit side—can be broken down into two groups under the main headings of (a) initial outgoings (or

the cost of setting up the department), and (b) the running costs.

The initial outgoings are:

(a) Cost of apparatus, tools and workshop equipment.

(b) Power, lighting, and heating equipment.

(c) Initial transport costs.

(d) Protective clothing and sundries.

The running costs can be resolved into:

(a) Wages and salaries.

(b) Percentage of initial outgoings for wear and tear, breakages, replacement of obsolete equipment, etc.

(c) Running costs of transport.

(d) Power, lighting, and heating charges.

(e) Insurance

(f) Clerical charges (stationery, postage, etc.).

(g) Advertising.

Any item shared with the sales side of the business should be taken as a percentage dependent upon the actual amount of use by each.

For the department to be economically balanced, its annual income should cover the running costs, repay the initial outgoings over a period of several years and permit the dealer to receive a percentage as profit. Whether the dealer will draw an income from his service department and still retain the goodwill of his customers must depend upon his ability to maintain efficiency and keep service charges down.

The dealer runs into trouble over the latter straight away. What is a fair charge for the work of his department? The simplest method of assessing it is that there should be:

(a) A basic charge covering collection, delivery, loan of replacement, and the presumption that the receiver is repaired within an hour's work.

(b) An additional charge based upon the time actually spent on diagnosis and repair.

(c) Cost of new components, valves, etc.

Admittedly, it will be argued with some justification that, if a fixed charge per hour is imposed, (item (b) above), some repairs will be unduly expensive and this charge will fall on the customer—with complete destruction of his goodwill. However, this objection does not bear examination, because if a dealer employs a service engineer, he presumably knows just how proficient he is, and if his employee is somewhat slow in finding faults and repairing them (a contributing factor incidentally, is inadequate or badly maintained tools and equipment), then it is up to the dealer to assess his charge per hour accordingly.

On the other hand, if a receiver really has a difficult, time-consuming fault, then surely it is permissible to make a fair charge for the work done—or else be occasionally charitable.

The real answer is to reduce to a minimum the time taken on diagnosis and repair, and to this end a yardstick of servicing efficiency should be adopted which will show the effect of any improvement or modification of servicing technique used by the department. A useful yardstick is found by dividing the numbers of receivers repaired into the length of time taken to repair them. The more extensive this assessment, the greater will be its accuracy.

Anything that is done to improve this RPH (Repairs Per Hour) figure will mean either increased profits or lower charges, because the efficiency of the department will be improved. A considerable improvement can be effected by employing the service engineer to diagnose faults only, and we can now consider an ideal service department based on this principle.

THE IDEAL SERVICE DEPARTMENT

When a customer reports a faulty receiver, a "Job Card" should be issued with details of complaint, name and address, etc., and then passed to the van-man. Collection should be speedy and a loan set offered at the same time.

The job card should be attached to the receiver and should travel through the service department with it. If the receiver has been serviced previously, the previous job card should be withdrawn from the file and attached, with a service manual, to the new card.

The receiver should be inspected by the service engineer, who should test it, note the fault, test the valves and make a cursory examination to see if the fault could be cleared without removing the chassis from the cabinet.

If it is not possible to do so, the receiver should then be passed to an assistant who should remove the chassis from the cabinet and then return the former to the service engineer. The cabinet should be thoroughly cleaned and polished prior to storing it to await the return of the chassis.

When the service engineer has diagnosed the fault and it involves the removal of a faulty component, the chassis is passed to another assistant who is responsible for the replacement of this component—the connection points of which should be daubed with brightly coloured paint to facilitate speedy removal—before returning the chassis to the service engineer for further test, diagnosis or adjustment.

Only the time spent on the receiver by the engineer should be chargeable, work by his assistants being incidental.

When the chassis has been passed as satisfactory, it should be refitted in the cabinet and then returned to the engineer for a final check on its performance before passing it on for despatch.

The advantage of employing such a team is obvious. The service engineer, by virtue of the fact that he is employed solely on fault diagnosis and testing, is able to deal with a large number of receivers in a day, because his time is not wasted in doing jobs which are easily done by less skilled staff. His RPH is high in consequence, and as a result his employer is able to offer him a correspondingly high salary. Furthermore, as he is in charge of the team, he has a satisfactory status.

A CENTRAL SERVICE DEPARTMENT

No doubt there will be a degree of hollow laughter about the employment of a servicing team—particularly from those dealers who have insufficient work to keep **one** service engineer fully employed, without adding two assistants to the staff. The writer agrees with them. Such a conception is ridiculous for all but

the large dealers with a proportionately large number of repairs every day.

However, the writer suggests that the whole problem of servicing, both present and future, could be solved by the co-operation of **several** dealers in setting up a central, independent, service organization which would deal with all their after-sale service problems. Such an organization would be able to employ a servicing team or teams, provide a common collection and delivery service (if desired), and dealers would lose nothing by co-operative effort to solve a problem that must face them all—a problem which many are unable to solve individually, but which is not insuperable if tackled collectively.

Such an organization would necessarily be independent of all the dealers involved, so that a small private company would have to be formed. Dealers holding shares would be entitled to make full use of the facilities offered by the organization, but, of course, these services would not be free, and a reasonable charge would have to be made for all repairs done. The charges need not be related to the service charge made by the dealer to his customer, but, in any case, should be as low as possible. Any profits would be paid out as dividends to the shareholders after an agreed percentage of profits had been retained as capital in the normal way.

The company, by dealing with the after-sales service of several dealers, would be kept fully occupied and would have a maximum efficiency as a result. First-class engineers could be employed who would receive a salary commensurate with their abilities, and could be encouraged to make a career in service work due to the very nature of the organization. The purchase of modern, highly accurate and expensive equipment and tools would be rendered easier, because the cost would be borne by the company as a whole.

There may be difficulties in founding such an organization, not least being the problem of getting a number of normally competitive retailers to co-operate. However, it should not be an insuperable task, because it would be of direct benefit to all shareholders, lightening what, in the future, must be a heavy load upon them, and leaving them free to concentrate on selling their wares to the public, in the knowledge that they can offer full after-sales service facilities with every purchase.

100-Volt Line Distribution

(Continued from page 31)

that with only some speakers connected, the amplifier will not be capable of its maximum output. But this does not matter, because the power required for each speaker has been determined in advance, so that although increasing the load impedance results in an amplifier which can no longer deliver its rated output, it cannot be called upon to do so. On the other hand, it can at all times supply the power called for by the speakers that **are** connected for the time being, the only proviso being that no more may be connected than will draw maximum power from the amplifier. And remember, at the very beginning, it was stated that the first step is to add up the total power required, and to provide an amplifier capable of delivering this amount. By doing things in this way, the amplifier can never be overloaded, even though it is not properly matched for maximum output unless maximum output is actually required.

FLEXIBILITY

It might be thought that having to have an individual input transformer for each speaker is a disadvantage of the system, but it really is a very minor one. In a large installation, many of the transformers will be very small and inexpensive, and they can mostly be of the small multi-match variety, so that anyone using the system for temporary installations would not have to be constantly changing transformers. To change the power fed to a given speaker only requires a change in the transformer ratio, and this is very easily done on a multi-match unit. Also, the cost of the amplifier output transformer is very much less than when the old system is used, so that even on this basis, the new scheme is not as unfavourable as might be expected. The real beauty of the method, however, is its extreme flexibility. It is also the answer to the old problem of how negative feedback may be used with an amplifier whose load is to be exceedingly variable, because a given amplifier, using the 100-volt system, never needs the ratio of its output transformer changed, whatever happens.

N.Z. Radio, TV, and Electrical Traders' Annual Report

(Continued from page 30)

Executive, and in particular the Secretary, Mr J. E. Beachen, chairmen and members of sub-committees, the press, and the journals "Radio and Electrical Review" and "The Electrical and Radio Trader".

WHOLESALE SECTION

Points from the report of the Wholesale Section, presented by the Chairman, Mr C. R. Peoples, concern:

Bona Fide Radio Dealers' List

This has been kept up to date, and wholesalers are abiding by their promise not to supply in any form goods to firms or persons other than those legitimately engaged in the radio industry.

Supply of Components

The de-control of condensers is viewed with satisfaction, and thanks are expressed to the Radio Traders' Federation for their joint work in presenting the case.

Apart from condensers the general supply position during the year has been quite satisfactory.

Price Cutting

The practice of one or two wholesalers of offering special discounts to dealers is frowned upon by wholesalers generally, as in the majority of cases, the wholesale margin is definitely insufficient. This question will be further investigated during the year. On the question of offering more attractive discounts, one master-distributor has taken positive action to stop such practices.

Selling Avenues of Various Appliances

Much contention has surrounded the avenues of sale for electrical appliances such as equipment for dairy companies, auto radios, electric razors, but now manufacturers and wholesalers generally agree that, providing they receive the co-operation and support of dealers they will distribute their products through the normal channels.

Bona Fide Wholesalers

This is a subject for Conference discussion, but, in view of the support given by wholesalers to legitimate retailers, it is hoped that the latter, in turn, will give all possible support to the regular wholesaler who is rendering an efficient service.

NEW PRODUCTS: LATEST RELEASES IN ELECTRICAL AND ELECTRONIC EQUIPMENT

This section of our paper is reserved for the introduction of new products and space preference is given to our regular advertisers. For further particulars contact Advertising Manager, R. & E., Box 8022, Wellington.

UNITELEX TAPE RECORDERS

John Gilbert & Co. Ltd., of Auckland, New Zealand agents for Unitelex (London) Ltd., have pleasure in introducing to the New Zealand market the new Unison M.R. 7 Tape Recorder.

With all the outstanding qualities of the old model, the Prima Recorder, the Unison has the new Truvox compact deck and an equalised high impedance output for playback through High-fidelity and P. A. systems.

Other features include British Standard tracking, Recording and Playback equalisation to C.C.I.R. specifications, high-fidelity 40 c/s to 11.5 kc/s. on playback, twin tracks and speeds—will play prerecorded tapes, maximum output 5 watts at 15 or 3-ohm impedance.

Messrs John Gilbert & Co. Ltd., of Tasman Buildings, Anzac Avenue, Auckland, C.1., will be pleased to supply all further particulars.

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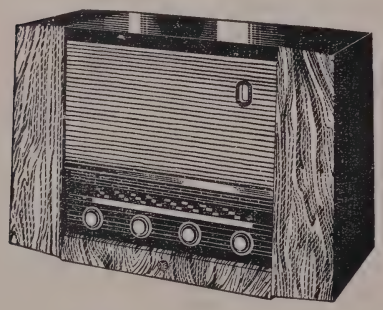
NEW PYE MANTEL

Model 106 — 6-Valve Bandspread



Pye 106 is a mantel radio, a six-valve bandspread. It will be appreciated for its truly glorious tone and clarity of reproduction, with the ease of station selection that bandspreading gives. This is indeed a typical Pye radio. Typical because with unobtrusive elegance it portrays the efficiency and the art of design with which Pye has always been associated, combined with the technical advancement and quality which Pye has made over the years—an accepted and appreciated Pye tradition.

Simple but elegant, at home in any surroundings, the cabinet in polished walnut creates immediately the impression of great worth. The radio public, the radio fan and the trade will recognise the sheer value of this mantel model by Pye, the 106, and the listening public after hearing its tone and considering the price of £39 5s. will recognise instantly its unusual value.

Today in radio, being a good set is not enough. The public demands everything in technical advancement. Performance has to be unexcelled, with ease and simplicity of manipulation, and the tone that makes "Stars" is demanded. With Pye 106 they will have it all, backed by all that the Pye name means.

Pye Ltd., P.O. Box 2839, Auckland. Branches at 43 Lower Taranaki Street, Wellington, and 16-18 Victoria Street, Christchurch.

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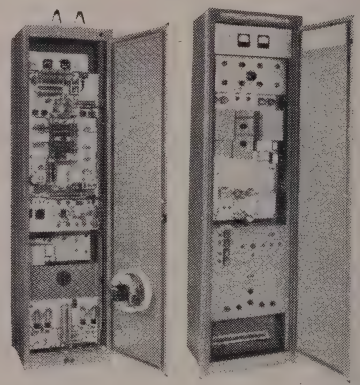
THE WESTREX 7-TYPE RADIO TRANSMITTING EQUIPMENTS



The Westrex 7-type Radio Transmitting equipments are for use in high frequency communication systems. These equipments consist of a multi-frequency crystal controlled radio-telephone and telegraph transmitter arranged to meet a variety of operating requirements. The 7-type systems have been specially designed for communication between aviation ground stations, ground stations and aeroplanes, point-to-point, ship-to-shore, and police applications.

"Building block" construction provides economies in the initial installation, yet allows additional features to be added at any time without make-shift arrangements or the discarding of any of the original equipment.

The simplicity of operating controls permit the operation of this radio transmitting equipment by non-skilled personnel.

The basic transmitting equipment consists of the 70A Radio Transmitter Unit, the 70A Output Panel, the 70A Meter Panel, and the 70 type cabinet. The transmitter unit and the output panel contain the radio frequency apparatus including the manual frequency selector mechanism.

A versatile Westrex radio receiving equipment known as Monatel already in use in many countries is also available for use with these transmitters. This equipment is manufactured by Westrex Corporation New York, of which Westrex Company, New Zealand is the local subsidiary.

TWO MORE PYE CAR RADIOS

For the coming summer two new Pye car radios are available to the listener-motorist. These new models are the 404/5 at £25 17s., and a de luxe model 501/2 at £35 19s. 6d. Both represent remarkably good value but they cater for a slightly different market.

PYE MODEL 404/5

Taking Pye 404/5 car radio first, one finds that it is an extremely neat and efficient job.

It sets an entirely new standard of quality and performance for a 5-valve radio designed for New Zealand motoring conditions. A small set, Pye Model 404/5, fits snugly into a small car and is, of course, completely unobtrusive in a large car. Its compact construction is ideal for fitting in special radio recesses. In spite of its compactness it has large clear numerals and call signs on a dial which is easy to read. Because of this clarity very quick and accurate tuning is assured.

Built with a backing of ample power, the components work well within their limits, thus ensuring long trouble-free life for the set. The 404/5 is in a single silver grey metal unit with a hammer finish. The speaker is a 6 in. Celestion mounted on a flock-sprayed facia with inter-connecting lead and plug. The actual dimensions of the radio itself are 7 in. wide, 2½ in. high, 7 in. deep.

Summed up, there is all the renowned Pye quality in 404/5 with scope and power at a price to suit the man of limited means—£25 17s. (retail).

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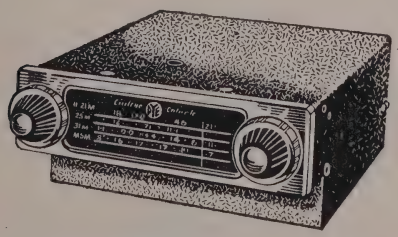

PYE MODEL 501/2

The 501/2 offers the height of luxury in car listening: a 6-valve bandspread model of de luxe design it offers really extraordinary performance.

It is presented in a three-unit form, tuner, power, and speaker. For ease of installation and to keep it both out of sight and out of the way the power unit is fully enclosed and very compact. The speaker baffle is pastel grey and is fitted with the necessary brackets for easy installation. The speaker used is a 6½ in. P.M. which gives full volume without distortion. The tuner unit has chrome escutcheon, black and chrome knobs, with a crinkle-black case. There are two concentric controls, namely: Tone and volume: Wave change and tuning. Tone is continuously variable from Bass boost and Top cut to fidelity and Bass cut. This car radio 501/2 by Pye has been designed with the needs of the motorist in mind. The use of the concentric controls for tuning is an added comfort to the driver because it really gives one-hand finger-tip control. This set is adequately screened against car interference and completely tropicalized for full reliability in any climate. Retail price of 501/2 is only £35 19s. 6d. There is a third model in the range of Pye car radios — the push-button model 808/809 at £37 19s. 6d.

All three models are, of course, available for both six and twelve-volt circuits.

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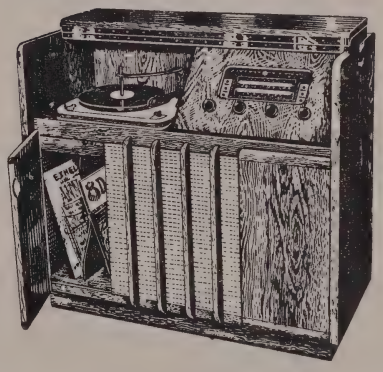
PYE MODEL 64 RG



Pye have chosen oak for the cabinet of their new console radiogram 64 RG. The model shows that blend of imaginative planning and superb craftsmanship which has become expected of all Pye products. 64 RG. is fitted with full length lid which gives free access to both gram and radio and allows easy handling of both. Record storage space is ample, conveniently placed beneath the gram, and affords full protection from dust or the possibility of damage.

The 4-speed Garrard auto-changer gives perfect service and in the planning the designers have allowed ample room for easy manipulation of all sizes of discs. A 4-knob control panel with brilliantly lit scale allows for instant station selection with speedy and completely accurate tuning. Power to spare is a characteristic of Pye 64 RG which is a 6-valve broadcast with R.F. stage. This Pye console is certain to win esteem if only for its sheer dependability and excellence of performance. It's appearance is that of the really high-class article it undoubtedly is. Retail price £75 15s.

Pye Radios, designed in Cambridge, England, are manufactured in New Zealand and distributed by Pye Ltd. Head office, P.O. Box 2839, Auckland.

NEW CLIPPER MODELS FOR ALL

This month we have pleasure in introducing to the trade three new "Clipper" models; two new radiograms appealing to different tastes and income brackets, and a brand new bright little portable that looks like being an odds on favourite for the coming holiday season.

CLIPPER 606 RG

The more luxurious of the two radiograms is the Clipper 606 RG. In a complete departure from conventional radiogram design this model follows the latest of "contemporary" furniture styles. The design is most attractive having great simplicity of operation as well as plentiful record storage space.

Meranti, a Malayan timber similar to mahogany, is the timber used in the cabinet construction, and this adds to the attractively "different" appearance of the cabinet. The whole design of the Clipper 606 RG is one of classic simplicity. As can be seen from the illustration, the body of the cabinet is raised about 12 in. from the floor on modern-style legs.

The highly polished exotic timber contrasts pleasantly with the soft, matt appearance of the fabric front, which has been carefully chosen to blend tastefully with the woodwork.

The dial and controls, which are offset on the right-hand side of the front, break the somewhat austere lines of the cabinet, and they are, in addition carefully positioned for easy visibility and operation. Brilliant lighting of the dial scale also makes for easier operation.

One further point about the cabinet that deserves mention is the lid to the record player compartment, which allows easy access when opened and fits snugly flush with the top, when closed.

The Clipper 606 RG is a 6-valve broadcast model fitted with a 3-speed Garrard auto-changer of superb quality.

A 12-in. moving coil loudspeaker gives volume without hum or overtone and the lighter frequencies on record or radio are crystal clear and free of whine. The high efficiency of design of this model, which incorporates a tuned R.F. stage, combined with the 12 in. loudspeaker, give exceptional clarity on distant stations.

At £72 10s. retail, the price of the Clipper 606 RG seems amazingly low considering the impression of luxury created by both the looks and performance of this fine radiogram.

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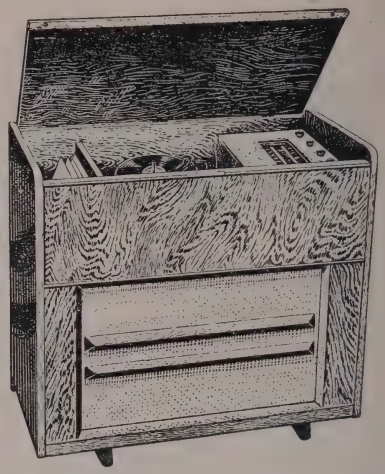
CLIPPER 601 RG



The second Clipper radiogram this month is the Clipper 601 RG. A new console radiogram, which has a distinctive and definite appeal, Clipper 601 RG gives remarkable performance at a remarkably low price. The highly polished oak cabinet, either light, medium or dark, is imposing and measuring 30½ in. long x 33 in. x 16 in., it is at home in any room. Designed for both elegance of appearance and economy of space Clipper 601 RG has ample record storage close to hand. Records are protected from dust and damage and yet conveniently placed.

The 3-speed record-changer unit will give complete and perfect service and the 12 in. heavy duty moving coil loud-speaker scientifically baffled for correct tonal balance gives gram reproduction of such fidelity that a minimum of loss is experienced in reproduction from the disc.

The Clipper 601 RG incorporates a six-valve broadcast receiver with waveband coverage of 1500 to 550 Kc/s. Sockets are provided to accommodate an extension loudspeaker of 2 to 4 ohms impedance.

The controls comprise tone (including on-off volume), tuning and a special radiogram switch to ensure fidelity of both standard and L.P. discs.

Fully tropicalized, Clipper 601 RG certainly has what it takes to please the whole family, and at 63 guineas (retail) it is priced for the family budget.

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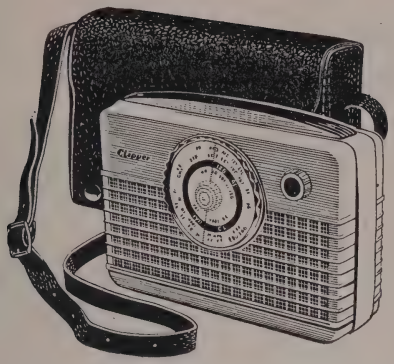
CLIPPER 4P6

This is the model that looks set to dominate the portable market this season. The Clipper 4P6 is light in weight and light in price: Weight, 4½ lb.; Price, £18 19s. 6d. retail. And this price, already low, includes a handsome, shoulder-strap carrying case that will add tremendously to the popularity of a type of portable that is already in steady demand.

The Clipper 4P6 is a 4-valve battery model, and one that is very economical on its batteries, with the



double advantage that it can be easily carried and easily played anywhere. Measuring only 9½ in. x 6½ in. the 4P6 is no larger than a good-sized handbag, and very little heavier, and seems to be the perfect set for beach and picnics, caravans and baches, and all summer outings.

Reliability under adverse conditions, and good all-round performance can be relied on with this new Clipper portable, and we feel sure that it will prove extremely popular with the public for its good looks too.

The Clipper 4P6, and all Clipper models, are distributed throughout New Zealand by G. A. Wooller and Co. Ltd., who invite trade inquiries to any of their offices. Head office, Box 2167, Auckland; Branches at 43 Lower Taranaki Street, Wellington, and 16-18 Victoria Street, Christchurch.

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THE TRANSISTOR CLOCK

In the U.S.A., an electric battery clock with a transistor has been put on the market by the Kieninger and Obergfell clock factory of St. Georgen (Black Forest). The clock is independent of current mains, requires no winding, and one single battery gives it a running life of about five years. It is directed electronically without contacts by means of a transistor.

SALE OF ELECTRICAL APPLIANCES, ELECTRICIANS ACT, 1952

In the interests of public safety, the Electricians' Registration Board directs attention to a statutory obligation placed on sellers of electrical accessories and appliances, and seeks the co-operation of all such in giving full effect to the following important safety provision.

Section 19 (5) of the Electricians Act, 1952, states:

"Every person who sells or offers for sale to anyone **other than a person registered, licensed, or authorized under this Act,** any material or device which is suitable or intended for electrical wiring work, shall display in a conspicuous position adjacent to the material or device at the time it is sold or offered for sale, a permanent and legible notice approved by the Board, having letters of not less than half an inch in height, to the effect that electrical wiring work must be carried out only by persons who are registered, licensed, or authorized under this Act. Every person who fails to comply with or acts in contravention of this subsection commits an offence, and shall be liable on summary conviction to a fine not exceeding £50."

This clause was written into the Act in an endeavour to prevent accidents, or fatalities, by ensuring that the purchaser received at least a warning of the necessity to have work carried out by a qualified person.

The Registration Board feels that this particular requirement of the Act should, by now, be sufficiently well known to those who sell to the public, electrical accessories and electrical appliances which are not sold completely wired.

The Board requests the co-operation of all firms in ensuring that notices are prominently and effectively displayed forthwith.

When there's a better switch
ARCOLECTRIC will make it
New Zealand Agents
GREEN & COOPER LTD. WELLINGTON.

SPECIALISTS IN A
SPECIALIZED FIELD.
MR. SERVICEMAN.
Our Universal Coils, types 40 (Aer), 45 (R.F.) and 41 (Osc) will replace any damaged R.F. Coil.
Inductance Specialists
THE N.Z. HIGH FREQUENCY SPECIALISTS
201 THORNDON QUAY, WELLINGTON, N.Z.
COILS, I.F. TRANSFORMERS, R.F. CHOKES, R.F.O.'s DIALS, SCALES, COIL ASSEMBLIES, GANGS, BUILT-UP UNITS, ETC.

Plessey
RADIO COMPONENTS
Variable Capacitors, Air and Compression Trimmers, Drives and Couplings, Vibrators, Chokes and Transformers, I.F. Transformers, Wavechange and Toggle Switches, Valve holders and Pilot Lamp-holders, Loudspeakers, Iron Dust Cores and Formers, Potentiometers, Cascap and Caslam Capacitors, Electrolytic Capacitors.
New Zealand Representative:
WILLIAM J. BLACKWELL
P.O. Box 1622. Auckland

N.Z. RADIO, TV & ELECTRICAL TRADERS' ASSOCIATION (INC.) HOLD ANNUAL CONFERENCE AT WAIRAKEI

At Wairakei Hotel, the New Zealand Radio, Television, and Electrical Traders' Association Incorporated, held a most successful annual conference on Saturday, 15th September. Members and their wives travelled to Wairakei on the Friday, and foregathered over coffee, and an assortment of other beverages that evening in preparation for the more serious work of the conference on the morrow.

A NEW CONSTITUTION RATIFIED

One of the most important items on the agenda was the approval of a new constitution which had previously been drawn up and circulated to members. This was passed unanimously. It had been found that on some matters (as is only to be expected) the wholesale and retail members do not always see eye to eye. As a result, the new constitution provides for separate wholesale and retail groups within the association, each with its own chairman and committee. In this way, groups are able to discuss freely, matters which possibly may be contentious between groups. Governing the Association is a Board of Directors composed of four representatives from each group, and a President, elected by the membership as a whole regardless of individual groups.

Thus, after the groups have thrashed out their own line on a particular topic, the way is open for a discussion on the same matter, in full conference, which then decides what action the Association as a whole should take. This year, the Conference was held, partly in the two groups, and partly in full. It was necessary, therefore, for "Radio and Electrical Review's" representative to split himself in two for part of the day.

CO-OPERATION WITH OTHER BODIES

The Association had invited the presidents of other Radio Trader associations, and the President of the New Zealand Radio and Electrical Traders' Federation to attend the conference, in order to discuss ways whereby the Association might be able to co-operate with these bodies, in taking action on matters of mutual interest, especially where concerted action was essential, such as in submitting cases to the Government or to the Board of Trade.

Conference discussed a scheme, prepared by Mr Garth Wilson. This suggested the disbanding of the New Zealand Radio and Electrical Traders' Federation, as such, and the establishment of a different kind of confederation between the Associations throughout New Zealand. In this way, the scheme suggested, it would be possible to have a concerted action by the associations, working together, without the expense attaching to a National headquarters.

Commenting on the proposal, Mr Griffiths, President of the New Zealand Radio and Electrical Traders' Federation, indicated that in its present form the scheme would not be acceptable to the Federation, but that doubtless some different basis of co-operation could be found. Several members supported the proposal, indicating that the membership of the Association as a whole would certainly not agree to re-affiliation with the New Zealand Federation. Finally Conference approved a suggestion that the scheme should be made a basis for negotiation with the Federation by the incoming executive, Mr Griffiths having intimated that the Federation's executive would be happy to discuss any means whereby the Federation and the Association might work jointly on matters of common interest and importance.

TELEVISION

Addressing the full Conference on this item, Mr W. J. Murphy, re-elected President for the ensuing year, expressed his disappointment with the Government's attitude towards the establishment of television in this country. After a short discussion, it was resolved to continue to press for an early introduction of a service, either by Government-controlled stations, or by private interests. In a statement issued to the press after the conference, Mr Murphy said:

"Procrastination, excuses, and half-promises are the answers we receive whenever we request some action on the subject of Television. The radio and television industry is being strangled by Government control and indecision. Traders are losing trained technicians, who are taking other jobs, or going overseas to study television. Factories and service shops cannot absorb the youth who wish to be apprenticed to the trade because of the shortage of technical men. Traders want the people to know that the Association is doing everything it can to get a decision from the Government on the standards to be used for television. The Government, however, will neither make any decision itself, nor allow private enterprise to install and develop a limited service. We are told that 'the time is not ripe', that 'a caucus meeting is studying the subject and is to report on its findings.' It is obvious that very little progress is being made.

"Smaller countries than New Zealand are enjoying television and it is already operating in most of the important countries of the world. The cost of installing television transmitters and maintaining a service is a bogy that is continually put forward as a reason for delay. This excuse is not a good one. Stations of limited range can be installed and operated at comparatively low cost."

"Television receivers can be built and marketed today at a price which most people can afford. Live and film programmes are available. All that is required is permission to commence this important service."

CONFERENCE COCKTAIL PARTY

Highlight of the weekend social activity was a most enjoyable cocktail party held after dinner on Saturday. Early in the evening the President, and the chairmen of the wholesale and retail groups were presented with most inappropriate "chains of office". Heroine of the evening was Mrs Tui Boulton, who spent the greater part of the night at the piano in the lounge, providing music for dancing and singing. Her efforts were very much appreciated by one and all, including the members of the Association's unofficial Ballet Group, which entertained during the proceedings with a bathing beauty parade. Aucklanders should note that Ted Larcombe was undoubtedly the belle of the ballet, followed closely by Garth Wilson and "Brack" Brackenbridge.

All told, the Association should be more than pleased with the results of this conference, which can be counted most successful in every respect.

TRADE WINDS

PHILIPS SALES CONFERENCE

Philips executives at the recent Branch Managers' conference worked as a closely-knit unit. Hence the above photo.

Four men who mean business came to Wellington for three eventful days at the St. George Hotel last month.

They were Philips Branch Managers, gathered for a sales conference to decide the regional co-ordination in their company's manufacturing and commercial expansion.

Marching girls present the highlights in the Philips march of progress which has led to the Carnegie Hall high fidelity concert equipment radiogram. Commercial Manager Ivan Webb is the commentator.

The men who made the major decisions were: Messrs R. P. Nisbet, W. L. Farquharson, H. T. Perkins and N. S. Williams, managing respectively the Auckland, Wellington, Christchurch, and Dunedin branches of Philips.

It was apparent during the discussions that these men have been assigned wider authority and greater autonomy than their counterparts in other electrical concerns.

Mr Leighton Lord, Managing Director, and Mr Dirk Hudig, General Manager, expressed enthusiasm about the results of the conference and the initiative shown by Philips branches.

The accent of the conference was on commercial and technical service to New Zealand retailers.

With his nurse ready to administer the anaesthetic, the conference doctor is impatient to begin operation —amputation of Doug. Harris' gouty foot. But demonstrator Ken Bennett has a better remedy—deep heat therapy with the Philips Infraphil infra-red medical lamp.

A team of marching girls presented the conference with the full sales story on the new Philips "Carnegie Hall" high fidelity concert equipment radiogram which is a first in New Zealand. The 12-valve Carnegie Hall introduces the stave-splitting Bi-Ampli transformerless circuit, two Hi-Fi concert speakers, mono-knob fully automatic tape recorder and 32 other new features.

The Carnegie Hall, aided by Doug Harris and Angus McMillan from Philips, entertained a Palm Lounge audience of 120 guests from trade and musical circles. Surprise event of the evening was a performance by Kiwi Philips and his Nocturnal Five who settled down to play some quiet swing arrangements.

A girl entered and tapped the clarinetist on the shoulder. He left the stage. Then the drummer was beckoned away. The rest of the musicians followed him out. But the music went on playing! It was coming from the tape recorder of the Carnegie Hall which provided the entire evening's musical programme—a striking demonstration of the realistic listening possible from this high fidelity concert equipment. The visitors also met Mr Murray Allardice, chief design engineer for Philips in New Zealand.

During the second day of the conference the Philips Branch Managers were entertained by imaginative demonstrations of the Philishave, the Infraphil, the Philips Valve Merchandiser and Expanda Box system. This handy system will shortly be available to New Zealand retailers wishing to make their valve stock system more convenient. —P.B.A.

THE NEECO BALL

The nine Branch Offices of the National Electrical and Engineering Company Ltd. (NEECO), were represented by cartoon motifs of a local character, e.g., Mooloo for Hamilton office, oysters for Invercargil, etc., whilst the company's monogram symbol, picked out in silver, formed a background to the orchestra at the Company's Annual Ball at the Majestic Cabaret on Friday evening, September 14th.

Souvenir ashtrays were provided for the guests, this being a novelty gift that has become a part of Neeco Ball presentation.

BUSINESS FOR SALE

A sound, established radio, electrical, cycle, and sports business showing excellent returns, located in a progressive country district of the South Island, is being offered for sale.

Leading exclusive agencies include radio, all electrical appliances, and sporting equipment. Owner is retiring, and it is proposed to effect transfer as at 31st March, 1957. Any intending purchaser may, after investigation, make a firm agreement accordingly.

Price £6,000, with stock at valuation. Full particulars will be supplied to bona fide interested parties, and all inquiries will be treated with strictest confidence.

Apply to:

"OPPORTUNITY,"
C/o Radio & Electronics (N.Z.) Ltd.,
P.O. Box 8022, Wellington

A capacity attendance included staff members and friends, and a strong contingent from the electrical and allied trades. Mr D. H. Shortt, Wellington Office Manager, and Mrs Shortt, received the guests.

The Neeco Ball Committee comprised Miss J. Goldsack, Miss S. Ransom, Mrs M. Robinson and Messrs D. H. Shortt (chairman), D. Cracknell and N. H. Matthews.

PHILIPS TO DISTRIBUTE "CORONET" RECORDS IN NEW ZEALAND

Most exciting news in the record world is that the Coronet label, which represents American Columbia in Australia, will be released in New Zealand through Philips Electrical Industries of New Zealand Limited.

This label—the only octagonal one in the world—will appear on a wide range of standard, 45 r.p.m. and long-playing records, and will include not only artists who have won most favour among New Zealand listeners, but also many new ones.

Herald of the announcement was Mr Jack Argent, General Manager of Coronet Records, who paid a brief visit to this country early in September. Guests at the cocktail party given at the Hotel St. George, Wellington, to celebrate this important event, were entertained by human tales of the Coronet artists related by Mr Argent, and afterwards spent a happy hour listening to some of the Coronet recordings.

"The Coronet label", said Mr Argent, "will be of special interest for New Zealanders, because you seem interested in how music is made—what goes on behind the scenes in making a record. For instance, one of our recent recordings—of a real life rehearsal by conductor Bruno Walter—was played on 2YC as part of the Mozart Bicentenary programmes. I also feel that our personal meetings with the artists who make the records will enable us to establish closer contact between the recording artist and the public for whom he performs. Artists themselves also rely a lot on their own recordings to develop style and technique. "Satchmo" was very interested in his own recording—made by Philips in Milan during his lightning world tour—when he heard it for the first time in Australia. We also hope that the Coronet organisation will be able to arrange for more leading artists to visit New Zealand."

As we have already said, Coronet represent American Columbia in Australia. The latter is the oldest and the largest record company in the world, and amongst its artists already well known to New Zealanders are Doris Day, Frankie Laine, Jo Stafford, Johnny Ray, Rosemary Clooney, and Ken Griffin. Before long, New Zalanders may expect to hear a good deal of the work of many other famous artists per medium of Coronet records.

PRODUCTION OF WASHING MACHINES AND OTHER HOUSEHOLD APPLIANCES

A record number of washing machines—62,000—were produced in New Zealand in 1954, according to the Department of Industries and Commerce. Because of this, and the fact that machines were imported, production dropped to some 45,000 units last year. Future requirements will probably remain at last year's level.

The number of electric ranges produced increased from 27,000 to 31,500, and indications are that production is again on a lower level this year.

Domestic refrigerator production increased from 50,000 in 1954 to over 75,000 in 1955. There is a growing preference for larger refrigerators, and it is estimated that 37 per cent of the units produced were over six cubic feet in capacity.

PYE RECORD YEAR

Record profits of £2,331,848 before tax, were earned by the Pye group of Companies, English manufacturers and distributors of radio, television, and electronic equipment, during the year ended March 31, 1956. This is an increase of £132,546 over the previous year's record figure of £2,199,302. Tax charges, up by £86,850 take £1,248,527 and profits after taxation stand at a record of £1,071,489, an increase of £47,929 over the previous year's £1,023,560.

Cable advice from Cambridge, England, to Mr George A. Wooller, Pye Limited Director for Australia and New Zealand, reports the Directors' recommendation for final dividends on Preferred Ordinary Stock of 3% actual less tax, and 2% participating less tax, making 10% for the year (unchanged), and on Deferred Ordinary and "A" Deferred Ordinary 12½% less tax (unchanged). Figures are subject to completion of audit.

New Zealand members of the Pye group of companies include Pye Limited, Auckland; G. A. Wooller and Co. Ltd., Auckland; Akrad Radio Corporation Ltd., Waihi; Green and Cooper Ltd., Wellington. Australian subsidiaries are Pye Pty. Ltd., Melbourne; Tecnico Ltd., Sydney, in association with Bendix-Tecnico Pty. Ltd., and F. W. Davey and Co. Pty. Ltd.

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PHILIPS CHIEFS TO MAKE FLYING VISIT

Mr Leighton Lord, Managing Director, and Mr Dirk Hudig, General Manager of Philips Electrical Industries of New Zealand Limited, will fly to the U.S.A., England, and the Continent this month for discussions on the expansion of their company in New Zealand, on both the manufacturing and commercial side.

Since this expansion will embrace television, radio and other electronic products, the talks will concentrate on these subjects. A major point will be that of seeking efficient New Zealand television production. As already announced, Philips will be tendering for TV transmission equipment and also producing TV receivers at the new £300,000 Naenae production centre—another important item on the visitors' agenda.

Mr Lord and Mr Hudig are to return via the U.S.A. to confer with their American colleagues on electronic developments of particular interest to the New Zealand trade and industry. We expect them back by mid-November.

—◈—

STAFF CHANGES OF PHILIPS EXECUTIVE

Mr R. Slade: In order to cope with the expanding activities of E.D.A.C., Mr Ralph Slade welcomes **Mr A. I. Webb** to take his place as Commercial Manager of Philips, New Zealand. **Mr M. H. Harding** has been appointed General Sales Manager, in which role he will concentrate on sales promotion and sales publicity to aid retailers. **Mr Bruce Garden**, at present chief of Measuring Instruments Department at E.D.A.C., will switch to his new appointment as head T.C. man at the beginning of November. He will ensure the technical commercial link-up for radios, musical equipment, and all main apparatus. **Mr Doug Harris** moves to the Philips records department to handle sales and sales promotion of records and allied lines, under the guidance of Mr McMillan.

CLASSIFIED ADVERTISEMENT

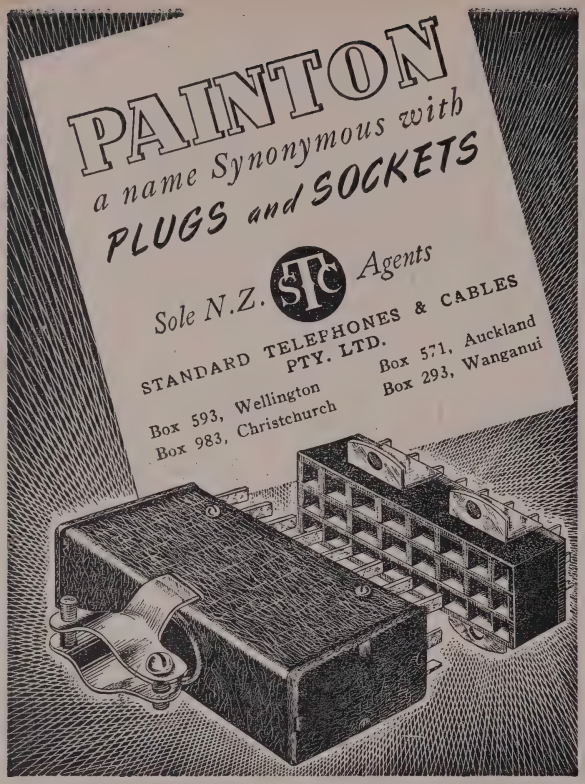
FOR SALE: COSSOR DOUBLE BEAM OSCILLOGRAPH, Model 339. Brand new condition. What offers? W.S.C., c/o "Radio and Electrical Review".

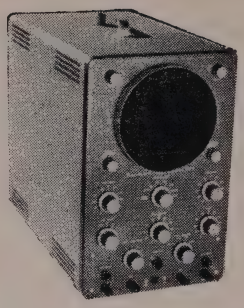
PREVIEW OF THE "CARNEGIE HALL"

Last month Philips Electrical Industries of New Zealand Ltd. commenced a buzz of new commercial activity by introducing to the trade two new models. The first of these, the "International TV Companion" will be familiar to readers of this journal, as it was featured in the "New Products" page in our September issue.

Right "out of the box", though, was the "Carnegie Hall", a radio-gram combination in the higher price class that really does provide the buyer with something more for his money than he gets from other models we have heard. This model uses what are undoubtedly the most advanced techniques yet featured in New Zealand-built commercial equipment. The Carnegie Hall is an attempt to provide what may be termed "packaged hi-fi", and a remarkably successful attempt, too. The special features incorporated in its design on both the audio and radio sides make a list as long as one's arm, and they are not of just the usual sales-talk variety. Technical readers will be more than interested in the "Philips Experimenter" article in this issue, which departs from established practice to the extent of describing some of the remarkable technical innovations incorporated in this set, so there is no point in enlarging on them here.

The preview was attended by a large number of Philips dealers, who were invited to attend a very pleasant function held in the Palm Lounge of the Hotel St. George, in Wellington, early last month. This was something of an occasion, as it also provided an opportunity for many of us to meet for the first time Mr Dirk Hudig, Philips' new General Manager. In the course of the evening, Mr Hudig mentioned that, to his knowledge, no commercial radio-gramophone anywhere in the world, could approach the "Carnegie Hall" in technical conception or performance.





HEATHKIT

5" T.V. BROADBAND OSCILLOSCOPE

(IN KIT FORM)

This outstanding instrument provides all the facilities normally found only in instruments of more than twice the price.

Not a toy, but PRECISION instrument specially provided with all facilities required not only for TV servicing but also for all radio and amplifier work requiring a fine instrument at a reasonable price.

Easy-to-follow instructions. Printed circuits facilitate accurate wiring and better performance. Broadband amplifiers, push-pull, built-in sweep generator, and numerous other refinements. Styled in the HEATH tradition. Supplied complete with scale.

Price: £68 3s. Retail

You BUY Test Equipment, but you INVEST in a HEATHKIT

Ask for them by name . . . HEATHKIT

Trade inquiries to:

FRED ROTHSCHILD & SON

79-83 PRETORIA STREET, LOWER HUTT.

P.O. Box 170 — Lower Hutt.

light up your living...

ENSIGN

LAMPS and TUBES

they're Britain's Best

Now available in New Zealand . . . longer life, combined with greater brilliance. Available in all sizes and types. Buy the best . . . buy ENSIGN.

Obtainable wherever lamps are sold

New Zealand Distributors:

P. C. BLENKARNE LTD. AUCKLAND, HAMILTON, PALMERSTON NORTH, WELLINGTON, CHRISTCHURCH, DUNEDIN.

HOUSEHOLD REMOVALS BY RAIL

Don't let that long-distance move worry you . . .

Call in expert advice and assistance.

. . . Consult any railway station-master or railway goods office . . . Benefit from long experience.

Complete house-to-house service, including all packing and unpacking and full insurance cover, is offered by the Railways!

AT YOUR SERVICE!

NEW ZEALAND RAILWAYS

SPEED and PRECISION

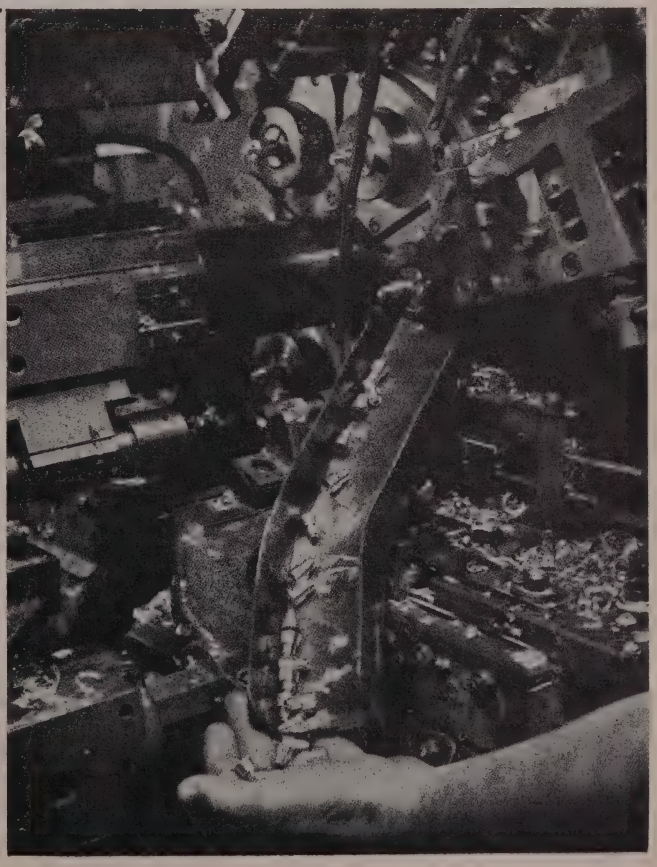
TWO OF THE VITAL FACTORS IN THE MANUFACTURE OF COMPONENT PARTS! And two of the basic reasons why every day more and more manufacturers throughout New Zealand turn to us to supply their factories with parts.

We have the modern machinery to mass-produce any part which can be made from stock up to 2¼ inches in diameter . . . we have the skilled technicians to guarantee perfect uniformity and accuracy . . . PLUS the organization behind both men and machinery to ensure that your order is fulfilled to your entire satisfaction and ON TIME.

IF YOUR PROBLEM IS COMPONENT PARTS, YOUR SOLUTION IS . . .

AUTO MACHINE MANUFACTURING CO. LTD.

18-20 NELSON STREET, AUCKLAND, C.1
P.O. BOX 179. TELEPHONE 31-638



Perfect Record Reproduction for the Critical Listener!

COLLARO

Model 2010 Transcription Unit

Model 2010 is mounted on a rectangular unit plate and is equipped with a STUDIO "PX" High Fidelity pick-up head, comprising a special low resonance arm and special bearing.

HIGH FIDELITY AT LOW COST

TURNTABLE — specially balanced non-magnetic turntable with a weight of approximately 8½ lb. and is fitted with a rubber turntable mat. The weight of the turntable is so disposed that the majority of the weight is at the periphery, thus giving a flywheel effect.

MOTOR—available for A.C. voltages of 200/250 volts at 50 cycles per second. Silent running and with absolutely "wow"-free performance.

THREE-SPEED GEAR—an entirely new type of 3-speed mechanism has been designed to give absolutely uniform turntable speed, while improved technique in the construction and assembly of the motor ensures reproduction free from rumble and frequency modulation.

PICK-UP—it is fitted with a tubular metal arm which has a very low resonance, and the arm is so designed as to be capable of playing 16-inch records. The pick-up insert is housed in a new attractive head moulding which is fitted with finger-tip control to enable the pick-up to be placed accurately and carefully on the record. An adjusting screw is fitted to the unit plate adjacent to the pick-up base to give free suspension of pick-up support.

SPEED CHANGE AND "OFF" SWITCH—conveniently situated on the right-hand side of the unit plate. There is an "OFF" position between each speed. Switching the unit from one speed to another automatically switches off the motor during the speed change. Switching to any speed automatically starts the motor.

45 r.p.m. ADAPTOR—This adaptor is permanently spring-loaded on the turntable and no other fittings are required for playing 7-inch 45 r.p.m. records with large centre holes.

Model 2010, with "Studio" Px Pickup,
£20 4s. Retail

Model 2010, without Pick-up,
£15 8s. 6d. Retail

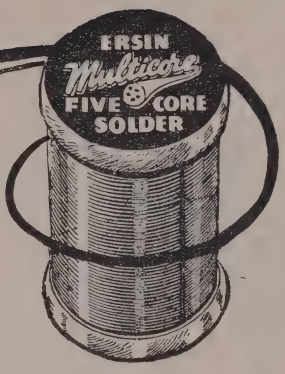
FOR FURTHER INFORMATION, INQUIRE FROM THE NEW ZEALAND DISTRIBUTORS:

RUSSELL IMPORT CO. LTD. P.O. BOX 102 WELLINGTON

"the finest cored solder in the World"

ERSIN

MULTICORE SOLDER



Available ex-stock in a range of gauges and alloys to meet all requirements

GEI.6

New Zealand Distributors: GILES & ELLIOTT LTD. Wellington, Auckland, Christchurch, Dunedin.
Also available from all branches of Turnbull & Jones Ltd.

Now available in New Zealand

EKCO LAMPS and TUBES

BRITAIN'S FINEST

they're better to see with

The complete range and types of EKCO Lamps, Fittings, and Control Gear, conform with the current British standards, and to the highest standards of efficiency and manufacture. . . . The perfect product of top British engineering.

NEW ZEALAND DISTRIBUTORS:

JOSEPH NATHAN & CO. (N.Z.) LTD.

AUCKLAND : WELLINGTON : CHRISTCHURCH

a quality British product

Hi-Craft LAMPS & TUBES

All the engineering skill and experience of Britain's largest old-established manufacturer results in the almost perfect HI-CRAFT Lamps and Tubes. A complete range of sizes and types IS NOW AVAILABLE IN NEW ZEALAND.

NEW ZEALAND DISTRIBUTORS:

HAMER ELECTRICAL CO LTD.

AUCKLAND, CHRISTCHURCH, DUNEDIN.

N9.6

For every budget!

every kitchen!

every cooking requirement!

NEECO

Consort

Low price, advanced features.

Sovereign

Medium price range, popular choice.

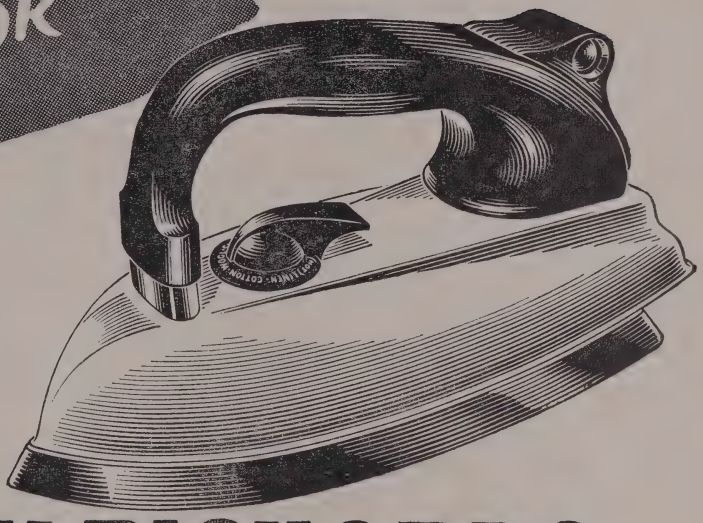
Ensemble

"Eye-level" cooking. fully automatic.

THE NATIONAL NEECO ELECTRICAL AND ENGINEERING COMPANY LIMITED

AUCKLAND – WELLINGTON – CHRISTCHURCH
DUNEDIN – HAMILTON – NEW PLYMOUTH
WANGANUI – HASTINGS – INVERCARGILL

THE EVERYDAY IRON WITH THE LUXURY LOOK



The World's Best Seller

MORPHY-RICHARDS

Automatic SENIOR IRON

In Sparkling Chrome Finish . . .
only 67s. 6d.

Also in Porcelain or Coloured Finish . . .
from only 59s. 6d. with 3-pin plug.

FEATURES INCLUDE:—

- Tell-tale Pilot Light.
- Easy-to-read Fabric Selector Dial.
- Crossbow Thermostat suppresses radio interference.
- Ever-cool, easy-grip handle.
- In everyone's price range.

HEAT CONTROLLED STEAM AND DRY IRON

£4 17s. 6d.

Including Accessories. It uses Hot or Cold Tap Water and gives the right heat and steam for every kind of fabric. It's Heat Controlled when dry ironing, too. Safe - Simple - Efficient.

M·R· A POWER FOR GOOD IN THE HOME

NEW ZEALAND DISTRIBUTORS:

RUSSELL IMPORT CO. LTD.,

P.O. BOX 102, WELLINGTON.

NEVER MIND, OLD FELLOW, warmer days are ahead. As a matter of fact, my family have already reminded me of the sour milk, soft butter and 'bad' meat we always seem to have in summer and so we have decided to buy a G.E.C. refrigerator. They're so sensibily designed and such good value for your money.

Find out all about them at the showrooms of
BRITISH GENERAL ELECTRIC CO. LTD., Wellington, Auckland, Hamilton, Napier, Christchurch, Dunedin, Invercargill.

TELL YOUR CUSTOMERS . .

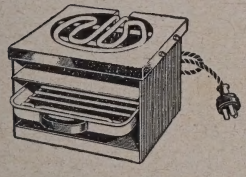
You can be sure of

Quality

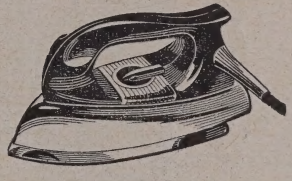
when you buy

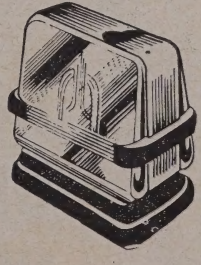
Ultimate

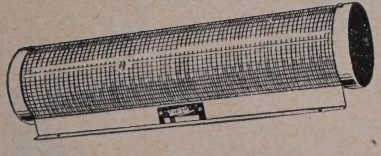
ELECTRICAL APPLIANCES

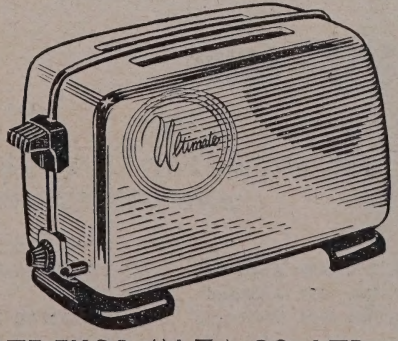


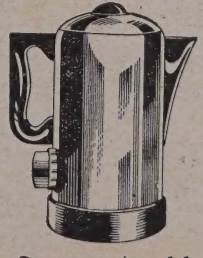
Tell them about the extra care that goes into *every* Ultimate product . . . about the non-rusting, longer-lasting metals used where corrosion could occur . . . about the final thicker coating of chromium that goes on. Tell them . . . then *sell* them — and they'll be your customers for life!



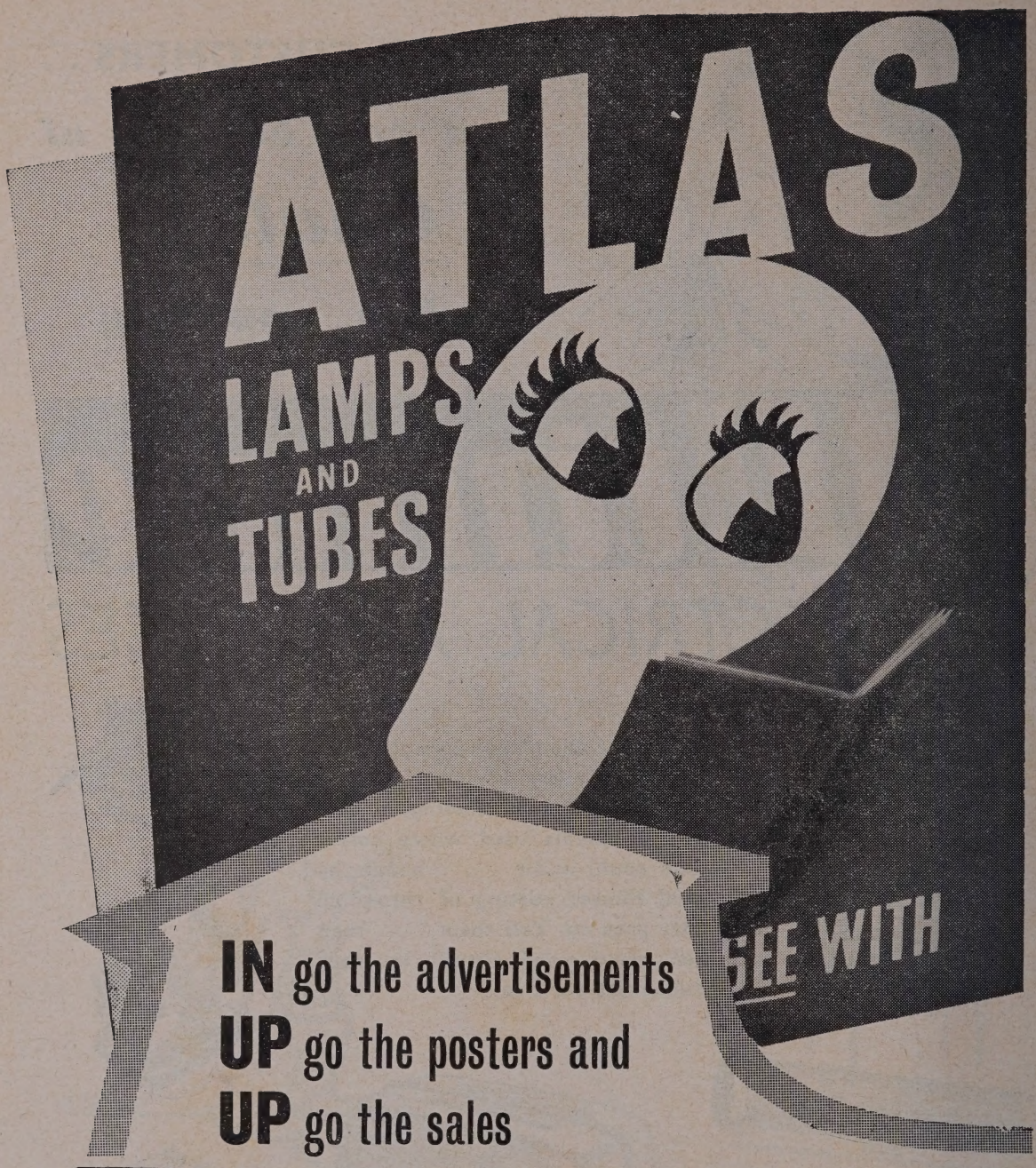








Quality Products of ULTIMATE-EKCO (N.Z.) CO. LTD. Quay Street, Auckland



IN go the advertisements
UP go the posters and
UP go the sales

Thorn

DISPLAY ATLAS LAMPS
PROMINENTLY IN YOUR WINDOW
AND TIE UP WITH THIS PUBLICITY DRIVE

New Zealand Distributors:

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ARNOLD & WRIGHT LTD P.O. Box 2253, Auckland
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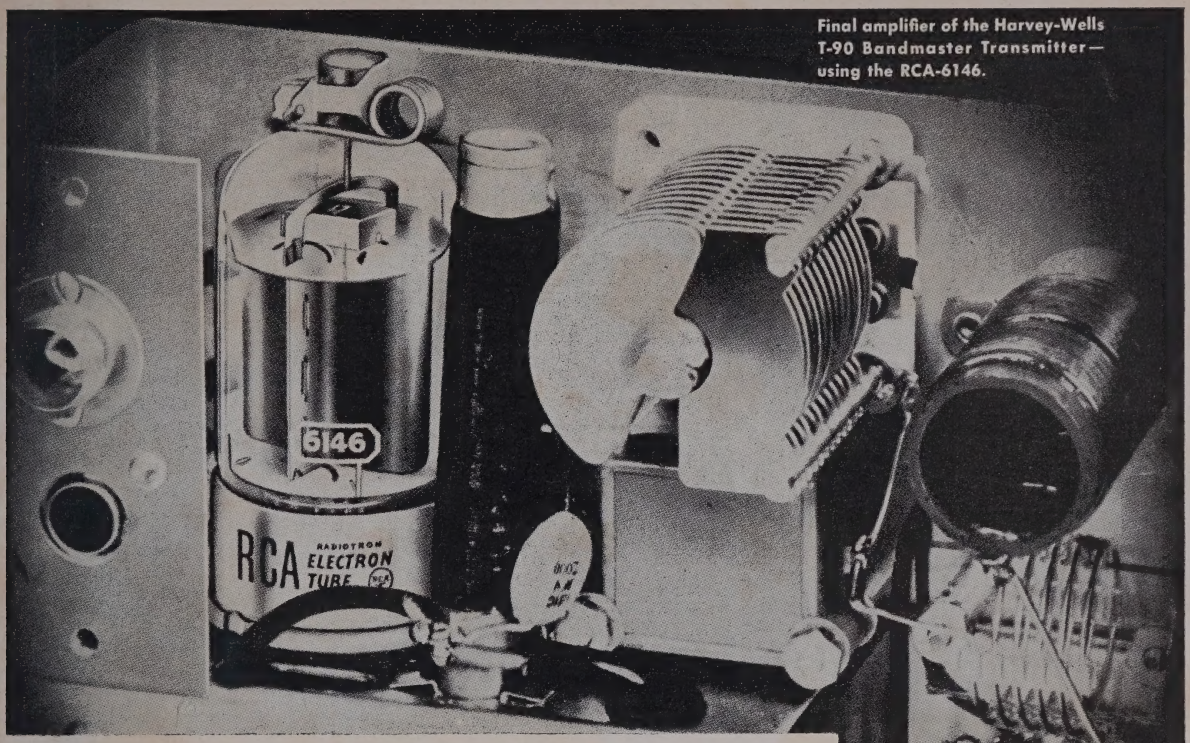
EGLEY ELECTRICAL CO. P.O. Box 765, Wellington
ZONTILIER FLUORESCENT LIGHTING CO. LTD.
P.O. Box 5030, Wellington
THOMAS HYDE LTD. P.O. Box 503, Christchurch



Final amplifier of the Harvey-Wells T-90 Bandmaster Transmitter—using the RCA-6146.

Leading Amateur Designs

...USE RCA TUBES

You are looking at the business end of a Harvey-Wells T-90 Transmitter. In this "final" an RCA-6146 beam power tube delivers the signal punch that gives this transmitter its reputation for ability to "get out."

Here's why RCA high-perveance beam power tubes, like the 6146, are preferred by leading designers of amateur and commercial transmitters.

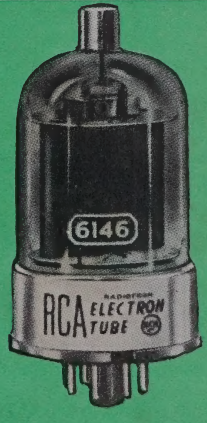
RCA beam power tubes make it practical to use fewer components, fewer tuning controls—*fewer stages*. They lend themselves to bandswitching circuits—take full plate input with smaller drivers (a big help in reducing TVI). RCA beam power tubes give you the power you want *at lower plate voltages*.

RCA High-Perveance Beam Power Tubes are available at your RCA Tube Distributor—for amateur transmitters having input-power ratings up to a "gallon." For technical data on any specific beam power tube type including the 6146, write

SOLE NEW ZEALAND DISTRIBUTORS:

AMALGAMATED WIRELESS (Australasia) LIMITED

P.O. BOX 830, WELLINGTON P.O. BOX 1363, AUCKLAND
P.O. BOX 2084, CHRISTCHURCH



BEAM POWER TUBE RCA-6146

90 watts ICAS input on CW; 67.5 watts on 'phone. Full input to 60 Mc. Reduced input up to 175 Mc.

THE *Advance* answer to mains voltage fluctuation . . .

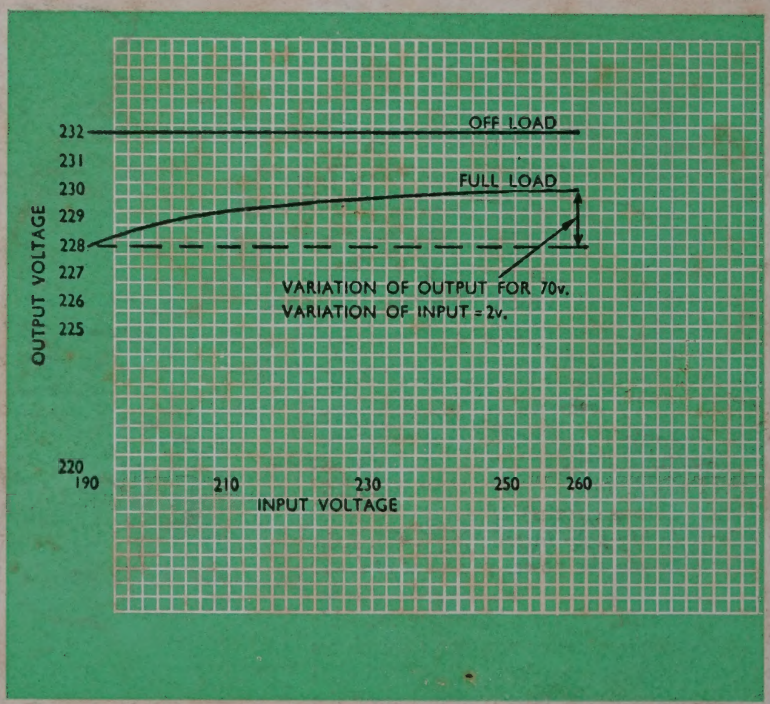
CONSTANT VOLTAGE TRANSFORMERS

Electrical equipment, whatever its function, cannot provide its optimum performance unless it is supplied with the specific voltage for which it was designed. This fact has long been recognised, but is today receiving even greater attention because of the new and more critical demands made by modern science, particularly in the field of electronics. Ordinary mains variations can have a very serious effect on the performance of laboratory instruments, on the testing and calibration of meters, X-ray and photographic apparatus, and many other industrial processes.

For many years "Advance" have specialized in the design of Constant Voltage Transformers for use with a wide variety of equipment where a stabilized voltage supply is demanded. Developments made in this field have resulted in making available not only a full range of stabilizers, but special types with a low harmonic content, and also particular automatic and adjustable voltage stabilizing devices for specific applications.

REGULATION.

The output voltage is substantially independent of load variation, but if good stability is required under varying load conditions, these conditions should be specified in order that a suitable model may be offered.



OUTPUT VOLTAGE

The stabilisers are normally set to within ± 1% of nominal voltage, and are adjusted to give a constant R.M.S. voltage. They can be specially designed to give a constant peak or average voltage.

150, 250, and 500 watt models are available ex stock.

Any capacity up to 6 kilowatt can be quoted for against indent.

FULL PARTICULARS ON APPLICATION TO SOLE NEW ZEALAND AGENT:

Turnbull and Jones Ltd.

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